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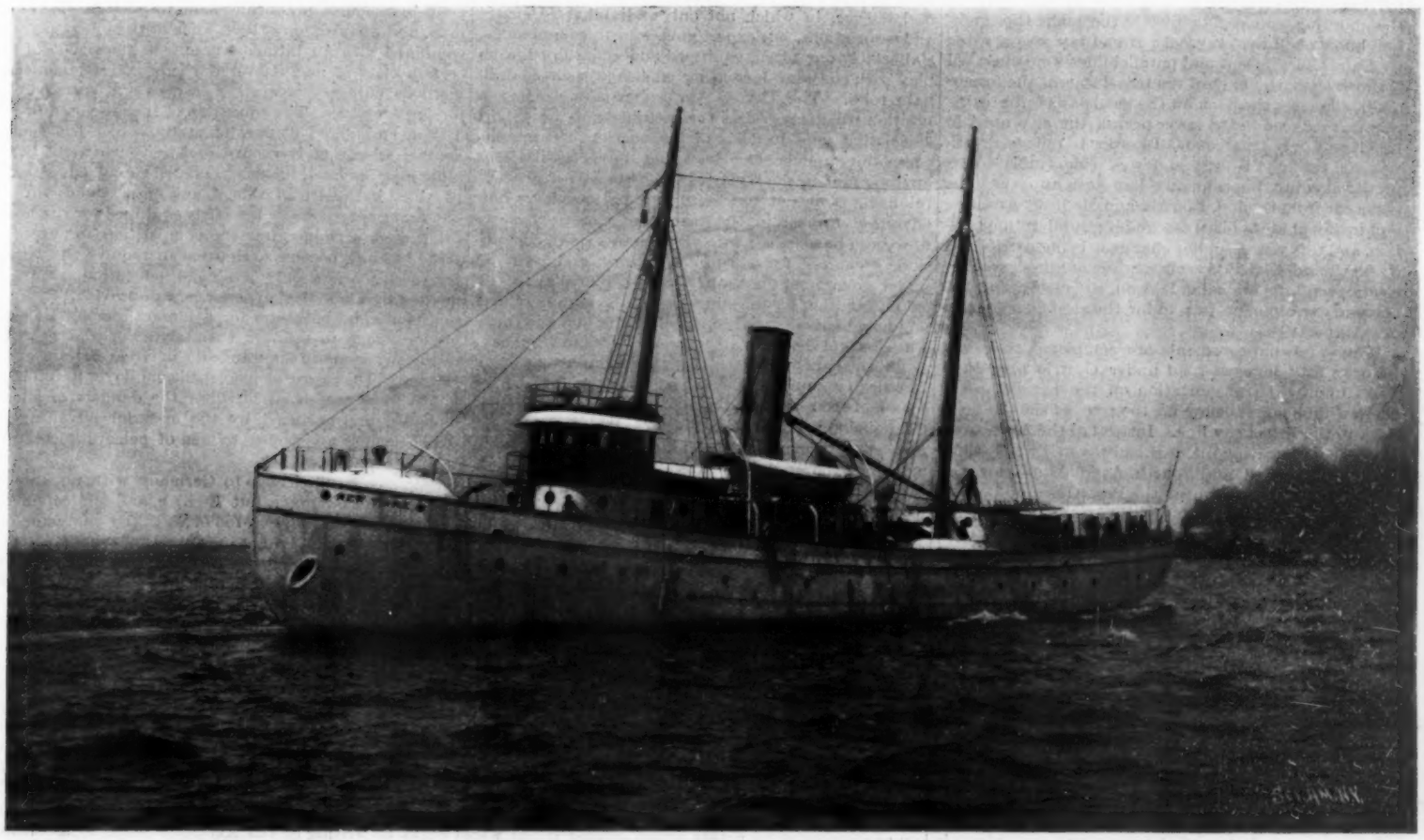
THE PILOTS AND PILOT BOATS OF NEW YORK.

The charm and romance which service on the sea possesses for those whose daily life is spent in more prosaic duties on shore, receive their highest expression in the arduous and hazardous calling of the pilots, who do duty off the various harbors that are strung out along our extended coastline on the Atlantic and Pacific Oceans. Of all the various local pilot associations or guilds, there is none that surpasses in interest or importance the body of men who are engaged in the service between Fire Island and Barnegat, upon the stretch of water that covers the approaches to New York Harbor. The history of this service is full of stirring incidents, even for a story of the sea. From the time of the early colonists of Manhattan Island, who kept a whale-boat at Sandy Hook, ready to place a pilot aboard the quaint Dutch merchantman, with its cumbrous stern towering high in air, down to the present day, when the stately liner, but six days out from port, picks up its pilot a few miles outside the harbor entrance, the record of the pilot service of this port has been such as to make the name of the "Sandy Hook pilot" familiar in every corner of the civilized world.

PILOT BOAT OF THE OLD SCHOOL.

The entrance door into the pilot's profession is guarded by a strict system of examination and apprenticeship extending over a period of six years. The boy of 16 or 17, who is ambitious to become a New York pilot, usually picks up his first experience before the mast in a service which lasts for a year and a half or two years. He then passes an examination before the Pilot Commissioners, who are chosen by the Chamber of Commerce and Board of Underwriters, in which he has to show a fair knowledge of the rudiments of education as taught in the public schools. The candidate must of course be in good physical condition, especially as regards his eyesight, the least degree of color-blindness being fatal in a profession which involves so much reading of signals by day and night. The successful candidate then enters upon a six years' apprentice-

(Continued on page 268.)



MODERN STEAM PILOT BOAT "NEW YORK"—OWNED BY THE NEW YORK AND SANDY HOOK PILOTS ASSOCIATION.

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NEW YORK, SATURDAY, OCTOBER 22, 1898.

RECONSTRUCTION OF NEW YORK STREET RAILWAYS.

In view of the deadlock which has occurred in the matter of providing New York city with a system of underground rapid transit, it is satisfactory to note the remarkable energy and ability with which the Metropolitan Street Railway Company is improving the vast network of surface railways which is included in its system. It is largely and almost entirely owing to the enterprise of this company that the New York traveling public has been able to travel to and fro on Manhattan Island with any approach to comfort or dispatch, at least during the past few years of the city's growth. In proof of this we have merely to consider what would be the present state of the transportation problem if those six great arteries of travel, Second Avenue, Lexington Avenue, Madison Avenue, Fourth Avenue, Sixth Avenue, and Eighth Avenue, were still served by the tedious horse car. It is safe to say that the Broadway cable line would have had to face an actual deadlock and that the elevated roads would have been congested to a degree that would have rendered travel upon them well nigh intolerable.

The system of the Metropolitan Street Railway Company has grown to its present proportions in the brief space of a dozen years, the expansion dating from the time when the first of the many smaller lines were added to the original Broadway road. At present the system includes 228½ miles of road of all kinds, of which, when the present changes are completed, about 90 miles will be mechanically operated.

The peculiar shape of New York city, which stretches out over an island 13 miles in length by only 1½ to 2 miles in width, renders the transportation problem peculiarly difficult. The business portion of the city lies at the southern end and the residence districts are located in the center and the northern half of the island. As a consequence the travel to the business portion gathers volume as it moves "down town," in the morning, converging toward the main thoroughfare known as Broadway. As Broadway was a cable road and the adjacent and parallel lines were operated by horse cars, the bulk of the travel sought the former road. To meet the demand the headway of the cable cars was reduced in the lower part of the city until in 1895 it was only six seconds. In order to relieve Broadway and confine the east and west side traffic to its proper avenues, the company last year abolished the horse car from Second, Fourth, and Madison Avenues, and installed in its place the underground trolley system, and this year a similar change is being carried out on Sixth and Eighth Avenues, while at the same time electric conduits are being laid on Broadway and the necessary equipment put in for the electric operation of this road.

When these improvements are completed, there will be over fifty miles of road under electric operation. With improved transportation on the parallel roads there will be no tendency on the part of the public to flock to the Broadway line. Instead of the down town traffic concentrating upon Broadway at Twenty-third Street, the Second and Fourth Avenue lines now tap the main thoroughfare at the Post Office and Astor Place, and the Sixth and Eighth Avenue lines make connection at the City Hall Park and Canal Street. The effect upon the Broadway road and the elevated roads (as far as the traveling public is concerned) has been excellent. While the overcrowding is still at certain hours of the day excessive, it is not nearly so marked as it was two years ago, and when the Sixth and Eighth Avenue improvements are completed, the improvements will be yet more marked.

Looked at from the engineering standpoint, the work of reconstruction now nearing completion on these two thoroughfares is of the highest merit, both for the magnitude of the work and the speed with which the change was accomplished without materially interfering with the city's traffic. The work to be done included the taking up and removal of fourteen miles of double track in two of the busiest thoroughfares in the world, replacing them with the heavy 107-pound rails, yokes, and equipment of the underground trolley system, and making the necessary changes in the various systems of electric light, telephone and telegraph subways, and in the gas and water pipes and sewers of the city. It was decided to do the work by paid labor under the company's engineers, in place of letting the work, as before, by contract. The old material taken out and the new material to be put in were distributed in the side streets, street crossings were boarded over (the work being done under cover), and every care was taken to interfere as little as possible with the city traffic. The vast array of mechanics and laborers was distributed along the works, and a simultaneous attack commenced at all points. In a few months, and with remarkably little interruption to traffic (considering the magnitude of the work), the change has been made. The cars ceased running on July 21, and the electric cars will be running on both roads by November 1 of this year.

The work of reconstruction has involved the removal of 3,600,000 cubic feet of earth and 1,130,000 superficial feet of paving. In each mile of the new track 275,962 separate pieces had to be handled and fastened in place, and the completed structure contains 50,000 cubic yards of concrete and a total weight of 8,500,000 tons of material. In the first two months of reconstruction 6,287 men and 460 carts were employed daily on the work, and latterly the force was increased to 812 carts and 9,000 men.

It will interest the public to know that this system of roads alone took in last year 60 per cent as many fares as all the combined steam railroads of the United States, that is to say, over half as many fares were taken in on 228½ miles as on 180,000 miles. This comparison surely establishes the claim of New York city that its street railway traffic is the densest in the world. The introduction of the transfer system reduced the car fare per passenger in 1887-88, when 1,996,871 transfers were issued, from 5 cents to 4·75 cents, and in 1897-98, when 90,000,000 transfers were given out, the average car fare was reduced to 3·48 cents, and for this sum a passenger, if he is so disposed, can make a continuous trip of over 20 miles.

The managers of this system are well disposed toward the proposed underground rapid transit scheme, as they consider that its construction would increase their own receipts by relieving their cars of the long-distance travel and leaving them to take care of the short-distance passengers. It is more profitable to carry three separate passengers for three trips of three miles each than to carry one passenger for the whole nine miles, and it is considered that the tunnel road would secure chiefly the long-distance travel.

This is the proper view to take of the proposed underground road, and the relief which it will afford to every form of transportation in the city will be in the nature of a surprise when the road is eventually built.

A NEW PROFESSION FOR YOUNG MEN.

The search for foreign markets may be justly said to have developed in recent times into an exact, specialized science, in which not only individual exporters and associations, but expert government commissions, elaborately organized, equipped and maintained, each play with constant increasing efficiency their co-ordinate roles. The United States has now reached a position which recognizes the usefulness of the export associations and bureaus of information, though the complaint is made sometimes that these organizations are too much in the hands of theorists and unsuccessful men. Some of the European nations have now advanced further in the science of export than we have, and have called into service an expert commission, organized for a specific inquiry, and sent out under government authority to gather precise technical information for the education of the manufacturers and merchants in special lines of production and trade. The efforts of Germany and France in this direction have established new systems to which the attention of American manufacturers and exporters cannot be too soon and too seriously directed. The German Export Commission was sent out February, 1896, to study the markets of China, Korea, and Japan, and returned after a year of thorough and carefully systematized work, bringing a vast collection of not only the art products or other merchandise ordinarily exported from those countries, but also of ordinary textile and other goods made in those countries for the use of their own people or for export to neighboring countries and in the production of which it is thought that German manufacturers, equipped with exact information as to size, quality, price, and extent of demand, might be able to compete. Neither the samples nor special reports made by the commission have been, or probably will be, made public, as they were obtained solely for the benefit of the German manufacturers. The samples were arranged in a suite of rooms at the Palace of the Imperial Diet, Berlin. Admission was only granted by card and had "to be obtained from a discreet official," says Consul-General F. H. Mason, of Frankfort. The collection was subsequently broken up or distributed at points where similar goods were or could be made in Germany, as for example at Crefeld, where the textile samples are in the possession of the Chamber of Commerce. The reports have not been printed as yet, and if they are, they will probably be reserved for confidential distribution among the German manufacturers and merchants who are specially interested in knowing the wants of these Eastern peoples, their ability to purchase goods to meet those wants and the prices they are able to pay for them.

Similarly in France, the commercial commission sent out by the Chambers of Commerce of five manufacturing cities, Marseilles, Roubaix, Lille, Bordeaux, and Lyons, has returned after an absence of nearly two years, and has presented its collection and reports to the Chambers of Commerce directly interested. Although none of these technical reports have yet been, or probably will be, published, it is known that they number more than one hundred, each prepared by an expert committee or individual. The general conclusion reached by the commission is that France's export trade with China, Tonkin, etc., has opened up a great future, provided the manufacturing exporters will make the best use of the specialized information that is now placed in their hands. While the direct and immediate fruits of these well designed and scientific quests for foreign markets will naturally, and justly so, fall to the lot of Germany and France, which organized the expeditions, still there are certain general facts and propositions which are suggested by these proceedings which, if rightly interpreted, may be of value to the exporters of the United States, who, as a class, have much to learn of the science of the export trade.

There is in all the specialized work of the commissions a broad recognition of the fact that in foreign trade it is the buyer, not the seller, who determines the kind of article he wants and the form in which he wants it turned out, labeled, and packed for shipment to him. It is the business of the seller not to force upon the consumer something he has never heard of and does not want, but to ascertain exactly what he has used and what has been sold to him hitherto, and then furnish him with something of the same kind—but better for his money—than he has ever had before. After this has been achieved, there may possibly be some field for the introduction of a new variety of goods and the gradual education of the consumer. At present the Germans are perhaps the ablest masters of this theory of the export trade, and the English are thought to have lost much for want of it, and America will undoubtedly excel in it when once manufacturers realize its importance.

Secondly, the goods must, as a principle, be sold not at home, but abroad. The seller must go to the buyer with samples, prices, and conditions which the latter can see and readily understand. Museums or other collections for sample merchandise are useful as far as they go, but they cannot attract more than a limited number of buyers to the United States, especially while other countries are sending merchants to the spot with a stock of goods, duty paid, and furnish salesmen to show and explain them. The need of our export trade is a class of competent, well trained young men, with good manners, a practical command of French, German, and Spanish, or at least some of these languages, combined with an intimate practical knowledge of a certain class of manufactured goods and commercial methods, currency, weights, measures, and customs of foreign countries. The education of such men requires certain specialized courses of study, which the commercial schools of Germany, and to some extent Belgium and England, furnish. The all-round education provided by American colleges and high schools turns out young men more or less fairly equipped for successful careers at home, but the competition for export trade has now become so sharp as to require the work of experts, which only a special education, supplemented by a practical experience, can provide. It will, henceforth, be necessary for a largely increased class of young men to prepare themselves for and accept definitely, as many thousands do in Great Britain and Germany, the career of mercantile employes in foreign lands, in which social sacrifice, the dangers of alien climates, are balanced by the material advantages which such a career offers to men of perseverance and trained capacity.

Salesmen frequently go to Germany with no knowledge of any language but English, and the commercial traveler puts himself too often in the character of a peddler by attempting to sell goods of wholly different classes and character. The commercial traveler in foreign countries should confine himself solely to one line of goods and should be an expert in that line.

American circulars and catalogues are often very faulty, and they should be printed in the language of the country to which they are sent, the values and weights and measures should be translated to those in vogue in whatever country they are sent to, and above all, the catalogue should state clearly the net price for which the machine or other article will be delivered at a prominent seaport of that country. The subject of discounts should be also clearly set forth. If this is not done, the buyer is forced to spend three or four weeks in writing to the American seller to ascertain his best discount, etc., and the chances are, in the meantime, that his order will go to a European manu-

facturer who either sends a salesman to take it or who has given the net price in his advertisements.

The unprecedented merchandise exports of the past fiscal year have given to the world a new and convincing proof of the power of the United States in the vast and varied field of manufacture. It will now be greatly to our advantage to understand at once, as the field of American commercial activity broadens and grows more complex and difficult, that the attainments and enterprise of the exporters and their agents must keep abreast of the new and more exacting requirements. The merchant of the present and coming generations must be like the diplomatic, the consular, or executive officer, a more highly trained and educated man than his father or grandfather had need to be.

THE REVIVAL OF AMERICAN SHIPBUILDING.

Unless the present signs are misleading, the war with Spain is likely to start, if it has not already started, that revival of American shipbuilding for which we have all looked so anxiously, and which, at the opening of the present year, appeared to be farther off than ever. The creation of an auxiliary fleet led to the purchase of a large number of the vessels engaged in our coastwise and West Indian trade. Several of these have been converted into such valuable auxiliary cruisers that the government has decided to retain them permanently in the service. As a consequence, the transportation companies have given orders for new ships to take their place, and it is very gratifying to note that, whereas many of the original vessels were built abroad, the new ships are being constructed in American yards. No better indication could be desired of the approach of the day when not only first-class liners, like the "St. Louis" and "St. Paul," but the cheaper vessels of the "tramp" class, can be constructed in American yards as cheaply as they can in Belfast or on the Clyde.

The effect of the purchase of merchant steamers by the government is seen in the fact that our leading shipyards are crowded with orders which will keep them in full swing for many months to come. Among others are four screw steamers for the American Mail Steamship Company and a twin-screw vessel for the New York and Cuba Mail Steamship Company. Two large steamers are being built at Chester, Pa., to take the place of the ships of the Old Dominion Line which were acquired by the navy and transformed into auxiliary cruisers. The great yard at Newport News, which recently witnessed the launch of the "Illinois," has on the stocks three new liners for the Morgan Line, two for the Cromwell Line, and two for the Pacific Mail. The fact that these orders are being placed at home proves that the cost of construction must have been greatly reduced of late years, and this, no doubt, is due to the great progress which we have made in the iron and steel industry. Not a little commotion was caused recently on the other side of the Atlantic by the announcement that an order had been given to an American firm to supply ship plates to an English shipyard. The cheap production of plates and frames, coupled with the lower wages that are paid for labor, and the fact that labor-saving methods and machinery enable us to turn out more work per man than is possible in foreign yards, are hastening the day when we can successfully compete with the world in the art of shipbuilding.

If history repeats itself we shall not only successfully compete with the world as shipbuilders, but actually lead it in the superiority of our productions; for in the days of our maritime prosperity, in the age of wooden shipbuilding, our sailing clippers were the most famous in the world. They not only carried more than two-thirds of our inward and outward trade, but they were successful in securing a large share of the trade of the old world. They were conspicuous in the tea trade between China and London, where their admirable sailing qualities were in great demand, and so great was their renown that several British shipowners purchased vessels that had been built in American yards.

In 1859 sixty-seven per cent of a total trade of $695,557,592 was carried in American bottoms; but since that time there has been an almost unbroken decline, which has been attributable to the change in the materials of shipbuilding from wood to iron and steel, while in its earlier stages it was, of course, hastened by the depredations of the Confederate commerce-destroyers. The change from wood to iron came too early for our undeveloped iron industries to enable us to cope with the new problem successfully; and while the wooden clippers made a gallant fight to maintain their old prestige, they were doomed to give way before the advance of steam as a method of propulsion. At the close of the civil war the proportion of our trade carried in American ships was only 27 per cent. It rose to 35·6 per cent in 1870, since which date there has been a steady decline.

The upbuilding of our merchant marine has been handicapped by a law which forbids the registration of foreign-built ships in the United States, to protect themselves from which, American owners have employed European steamers under long time charters. A striking instance of this is the West Indian fruit trade with the United States, which, although it is in American hands and backed by American capital, is carried on in foreign bottoms and under a foreign flag.

There is no denying the fact that with an era of "free ships" and some form of bounties for home-built vessels, a large number of ships now flying a foreign flag would hoist the American colors, and a large number of orders would be given for both home and foreign built vessels. The result would be that our merchant marine would begin to assume something of its old proportions. Just how far we have sunk in the matter of over-sea commerce is shown by the following comparison: In the decade 1850 to 1860 the yearly average of shipping launched was 276,000 tons, fifty per cent of which was for deep sea service, whereas last year the total tonnage launched was only 232,000 tons, in which was included not so much as one ship for the deep sea foreign trade.

CORRELATIVE THOUGHT IN THE MONKEY AND THE ELEPHANT.

BY JAMES WEIR, JR., M.D.

It is true that the lower animals very frequently, so it seems to us, find themselves in difficulties which could be easily overcome by a slight amount of logical ratiocination, which effort of reason they seemingly fail to employ; yet in this respect are we really superior to them? Does our own ideation differ so very materially when we are placed amid kindred or like environments? I think not.

Place man amid unknown and unfamiliar surroundings, and he at once, to a certain extent, becomes lost. Many things appear to us abstruse, occult, and beyond the powers of the human mind; many situations seem difficult, inexplicable, unavoidable. And yet, when these things are explained to us and we come to understand them, we wonder at our own stupidity, so simple do they become. It is a lack of *understanding*, and not an absence of ideation, in animals which makes them appear to us to be, on certain occasions, without ratiocinative power.

Ideation, to some extent, is present in all of the lower animals, and correlative, interdependent, commutual *thought* is unquestionably present in the mental operations both of the monkey and of the elephant, as I will now endeavor to show.

Several years ago, a capuchin monkey at the Fair Grounds in St. Louis, Mo., received an injury to one of his forepaws and I was asked to dress it. While convalescing, this little creature learned to know me intimately, and would always cry out with pleasure whenever he saw me. His attendant would let him out, whereupon he would caress my face with his paws, uttering meanwhile many low-voiced ejaculations of endearment.

One day, in order to see what he would do, the keeper refused to take him from the cage. The monkey appeared completely nonplussed and sat down, seemingly in deep thought. Suddenly he uttered a loud shriek, as though in great pain, and began to pace up and down his cage. He held the hand which had been injured, but which had now been well for several weeks, in his other hand, and appeared to be examining it with great solicitude. His object was at once apparent both to the keeper and to myself: he was feigning an injury in order to be let out!

This monkey remembered that when he had hurt his hand I was called and dressed the wounded member. He thought that, if he made it appear that he was again injured, he would be placed in my hands at once. The cunning little malingerer ceased to moan as soon as he was placed in my arms, and at once began to search my pockets for the dainties which he knew were there. Beyond question of doubt in this instance there was true correlative ideation. Thought followed thought in orderly and logical sequence until the full concept was formulated.

In the same monkey house there lived an ateles which also gave unmistakable evidences of being able to think correlatively. This monkey became the proud and jealous owner of a small, round, metal-backed mirror, which she kept securely grasped in one of her hands. She seemed to regard it as a great treasure, and was immensely afraid that the other monkeys would steal it from her. Wishing to see how she would dispose of it during feeding time, I suggested to the keeper that he prepare a basin of milk and bread and place it in the cage. (The ateles conveys its food to its mouth with its hands; consequently, the monkey was handicapped by having one hand already occupied.) She made a dash for the basin, but immediately recognized the fact that with only one hand free she was no match for the other monkeys. She ran about the cage for a moment or two, then, pausing, seemed to think over the matter. Suddenly she darted to the front of the cage, thrust her hand through the bars, and pressed the precious mirror into one of the keeper's hands! Then, free and untrammeled, she rushed to the bread basin, and began to shovel food into her pouches with both hands.

In a recent issue of La Nature M. Paul Méguin has an interesting article on the intelligence of monkeys. The following excerpt is taken from a paraphrase of the above-mentioned paper:

"At Hagenbeck's establishment, in Hamburg, where two hundred monkeys enjoy complete liberty at play in the great rotunda, they are given multitudes of children's toys, balls, hoops, wheelbarrows, joiner's benches, etc., and learn to manage them all without anyone showing them how. In the center of the rotunda is an immense grain-hopper, from which the seeds, corn, walnuts, chestnuts, apple-quarters, etc., run into a trough when a wheel at the top is turned. The management of this hopper did not have to be explained to our friends the monkeys. While one of them turns the wheel, the others, sitting around the trough, enjoy the delicacies as they come down, till the one at the wheel, thinking his turn has come, stops, gives the signal for some one to take his place, and comes down to get his share."

Here is an instance of complex ideation. These animals know that their food is procurable only by turning a certain wheel, a mechanism wholly unknown to their ancestors, hence completely outside the realm of instinctive or inherited knowledge. They know also that, unless some one is self-denying for the time being and will turn the wheel, they will get no food. Therefore, that unselfish individual always presents himself. Furthermore, this individual, after he has labored some time for the good of the community, has only to make known his wishes to be relieved, when another will take his place. Here there is a knowledge of cause and effect in which complex correlative ideation is clearly evinced. Moreover, the factor of unselfishness which is present points to an ethical element as well.

An elephant's skin is exceedingly sensitive, notwithstanding its great thickness. Flies, gnats, mosquitoes, etc., cause it considerable annoyance, especially when it is confined to a house and cannot procure dust to sprinkle over its body as a protection against their attacks.

In 1882, while standing in the carnivora house at the St. Louis Fair Grounds, I saw an elephant which was there stabled seize a mop broom with its trunk and skillfully brush away some flies which were biting its back at a place not to be reached by its tail or proboscis. It used the broom with as much dexterity as a man would evince under like circumstances.

Romanes gives an account of an elephant which was seen to break a bamboo picket from a fence. Then, manipulating the bamboo with its trunk, it splintered it beneath one of its fore feet. Apparently not satisfied, it again broke a bamboo picket from the fence and splintered it as before. Then, holding the splinter in its proboscis, it scraped with its point between one of its forelegs and its belly. In a few moments it dislodged a large elephant-leech, which fell to the ground and which was immediately crushed into a shapeless mass beneath the horny toes of the elephant! The animal deliberately manufactured an instrument through whose agency it was enabled to rid itself of an annoying parasite. Morever, it was not satisfied with its first scraper, but threw it away and made another, thus showing interdependent, correlative thought as well as discriminating judgment.

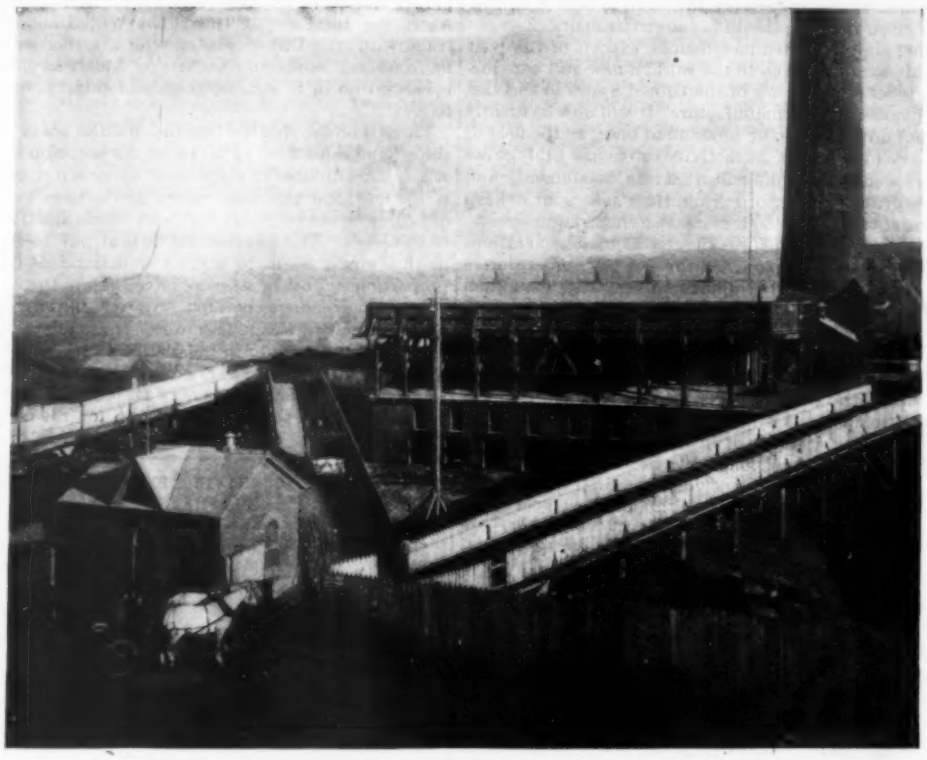
One winter, at St. Louis, two elephants were stabled in an outhouse near my rooms. One warm, bright day early in the spring one of these creatures was brought out into the alley behind the stable, in order that it might be given a bath. A horse attached to a loaded coal cart became frightened and ran at full speed down the alley toward the elephant. The latter heard the noise and saw the horse rushing toward him. He seemed to take in the situation at once; for, dropping to his knees, he drew in his trunk beneath his body, drew in his legs, and bowed his head. The horse, in his mad rush, ran completely over the elephant, dragging the heavy cart with him. Beyond a few slight scratches and bruises, the elephant was uninjured. Had it not been for his wise foresight and his quick formulation and adoption of his efficient method of self-protection, he might have been severely injured, perhaps killed, by impact of the maddened horse and heavy cart. In this instance there was an undoubted manifestation of correlative ideation. The immediate adoption of the only efficient means of avoiding injury clearly demonstrates the truthfulness of this assertion, especially so since there was nothing instinctive in the action of the elephant. In a state of nature, elephants are not confined in narrow alleys, neither are they charged by runaway horses.

THE United States consul-general at Berlin says that the area of carriage pavements in that city is 6,500,405 square yards. Of this area a little less than 74 per cent has stone pavements, about 25 per cent asphalt, and a fraction over 1 per cent wood pavement. The proportion of asphalt is steadily increasing. The soil consists of coarse, gritty sand, forming apparently an excellent foundation for the heavy 8-inch layer of gravel and cement, over which the 2-inch covering of asphalt is spread.

HOW SAN FRANCISCO DISPOSES OF ITS GARBAGE.

The contrast between the methods by which New York and San Francisco, divided by three thousand miles and situated the one on the western shores of the Atlantic, the other on the eastern shores of the Pacific, dispose of their unsanitary waste is marked. In New York the garbage and house refuse are kept in separate vessels; in San Francisco they are mixed together. In the former city the odors arising from pure garbage, kept for several days in warm weather in the basements or back yards of the householders, are apparent at a considerable distance; while in the latter city the garbage, mixed in the same vessel with the ashes from the kitchen and the other house refuse, practically has no odor. In New York the pure garbage is collected and loaded upon scows at the city's expense and delivered to the New York Sanitary Utilization Company, where it undergoes a reduction process at the company's works on Barren Island, and comes out into a residuum consisting of tankage and grease. In addition to the cost of collecting and hauling this garbage, the city pays $89,900 per annum to the reduction company. The refuse is carried out to sea by barges towed by tugs and there thrown overboard into the sea. The larger portion of this refuse finds its way to the beaches, and renders the Jersey shore anything but a pleasant abiding place.

In San Francisco it had been the custom from time immemorial to dump the garbage and refuse on vacant lots. Some ten years ago this system was changed, and the municipal authorities designated a dumping ground consisting of low and submerged lands in the southern district of the city, but, as that portion of the city grew up, the complaints against this disposition of unsanitary substances became numerous, and the municipal authorities finally decided to sell to the highest bidder a franchise for the term of fifty years for the sanitary destruction of this material. On February 17, 1896, the privilege of disposing of the garbage and refuse of the city in a manner satisfactory to the health authorities was sold to the highest bidder for the term of fifty years, in consideration of the payment to the city of $2,510 in cash and two per cent of the gross receipts for the first fifteen years and five per cent of the gross receipts for the remaining thirty-five years. This contract required the householders to have all their garbage and house refuse, the latter consisting of dirt, ashes, sludge, broken crockery, tins, cinders, bones, and other like material, also all putrid vegetable matter and condemned fish, flesh, and food, carried to the works to be erected by the contractor or his assigns, and to pay to such contractor twenty cents a cubic yard for such destruction, payable upon delivery. Here again the system differs from that in New York and the other Eastern cities, those cities collecting and disposing of their wastes at the city's expense, while in San Francisco the householders bear the entire burden. This system, however, is not altogether equitable, and a strong movement is now on foot to change it and to have the entire expense borne by the municipality. The garbage and refuse of San Francisco varies from two to three cubic yards per ton, a fair estimate would probably be two and a half cubic yards a ton, making the price paid by the householders to the contractor for destruction about fifty cents a ton, which is less than it costs the city of New York for reducing its pure garbage alone. This contract was assigned by the successful bidder to the Sanitary Reduction Works, of San Francisco, which company selected the Thackeray process of incineration, then and now in use on a small scale in one of the three sanitary districts into which the city of Montreal is divided; bought a block of ground in the southern portion of the city, and erected thereon what is now the largest garbage incinerator in the world.



GENERAL VIEW OF SANITARY REDUCTION WORKS, SAN FRANCISCO.

UNLOADING REFUSE, TOP OF CHUTES

The test run was made for thirty days during September and October, 1897, and on the 8th day of November last San Francisco entered upon its new era of a sanitary disposition of its poisonous wastes.

The main buildings consist of two incinerating houses, with the chimney between. They form together three sides of a square, 265 feet long by 95 feet wide, and two stories in height. There are sixteen large cells in each incinerating house, making thirty-two cells in all, with a grate area of 96 square feet each, aggregating 3,072 square feet of grates. Each cell has a maximum capacity of about twenty tons per twenty-four hours. These cells are the largest in use, the nearest approach to them in size being those of the destructors used in England, the largest one of which has 25 square feet of grate area. There are four crematory furnaces for the cremation of smoke and gases; these can also be used to meet any extraordinary delivery of refuse. The chimney is 265 feet high, with a concrete foundation 50 feet square by 3 feet thick. From the top of the concrete to the ground line it is solid brick 47 feet square, and steps back to 32 feet are 12 feet high. The trunk is 30 feet square by 40 feet high, with walls 8 feet thick from the top of the trunk to the top of the house. The walls are built circular, 210 feet high, making the chimney 265 feet from its base. The flue is lined with fire brick 50 feet high and topped with a cast iron cap of special design.

This is the largest and tallest chimney ever built to dispose of garbage and refuse. All the buildings are built in a substantial manner with solid brick walls, galvanized iron roofs, cast iron furnaces, grate bars and hoppers. The works are fireproof. A well has been sunk upon the premises furnishing pure water, and with a capacity of 10,000 gallons per day. A rag cleaning and bottle cleaning plant has also been erected, the former capable of cleaning 300 pounds of rags an hour and the latter can wash several thousand bottles per day. A furnace has been erected for the melting of solder from the tin cans and is now in operation. Tin baling works are also in operation, where the tin is baled and shipped to foundries and made into window weights. The inclined roadways, platforms, offices, and buildings cover an area of 400 by 200 feet. The total investment of the company has been about $150,000. The maximum capacity of the furnaces and auxiliaries is 700 tons per day, but the entire output of the garbage and refuse of San Francisco has not yet reached that figure. The scavenger wagons commence arriving at daylight and the deliveries are practically over by four o'clock in the afternoon. The works are surrounded by a high board fence. At the entrance is the office of the company, and through this entrance the wagons drive up inclined roadways to the top of the two incinerating houses, where the contents of the wagons are dumped down inclined chutes. On either side of these chutes the pickers take their places and pick out everything of commercial value, such as tin cans, bottles, rags, bones, and even old bread, which is sold to the Chinese chicken gardens. At the foot of these chutes are the mouths of the hoppers where the garbage and refuse enter. The cells themselves are plain rectangular furnaces with arched crowns set at an angle; the hoppers slope upward at the rear of the grates at an angle of about 45 degrees, terminating in their upper ends in a charging door. On each side of these hoppers are flues opening into a main flue. The

BASE OF CHUTES AND MOUTHS OF HOPPERS WHERE REFUSE IS SEPARATED.

products of combustion from the cells pass by means of the main flue to the crematory furnaces and thence to the chimney. After one charge of the garbage and refuse is burned in a cell, enough of it is left in the shape of embers and live coals to ignite the next charge coming down. In this way the fires never go out and the embers from one cell can always be utilized to assist the burning in another cell. A charge consists of about three tons, and can be thoroughly incinerated, according to the character of the material, in from 2½ to 4 hours. The residuum from this burning consists of ash and clinker, both of commercial value, the former proving an excellent base for a fertilizer, while the latter, ground up and mixed with ten per cent of lime, makes a very excellent mortar; or, mixed with concrete and clay in proper proportions, can be made into an ornamental brick of any color desired. The following is an analysis of the ash and clinker made during the test run:

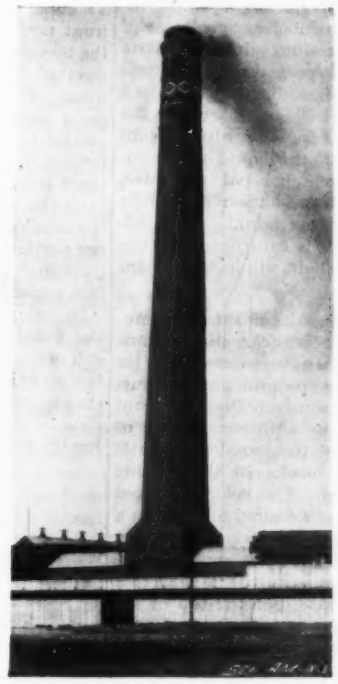
	Clinkers. Per cent.	Ashes. Per cent.
Unconsumed carbonaceous matter	1·82	6·74
Silicon dioxide	51·91	45·54
Iron sulphide	2·73	0·75
Copper sulphide	0·86	trace
Lead sulphide	0·48	trace
Phosphoric acid	0·81	2·52
Aluminum oxide	14·30	12·71
Iron oxide	1·00	1·92
Calcium oxide	15·45	19·59
Magnesium oxide	1·89	1·26
Potassium oxide	0·82	1·46
Sodium oxide	1·73	0·83
Sulphur trioxide	1·64	4·10
Carbon dioxide	3·04	2·34
Loss and undetermined	0·62	0·24
Total	100·00	100·00

The furnaces are so simple and have been built in such a substantial manner that they will last for a long time. When repairs are necessary, one cell can be closed down without interfering with the burning of any of the other cells. The cost of burning is limited to the cost of labor. There are 23 men now employed at San Francisco in the incinerating department. This is outside of the number of men employed in the picking department, which more than pays for itself.

After the works had been in operation for a few months it was found that the entire output of the city could be burned in the daytime, the furnaces being charged at night and regulated to burn till morning. This made a big cut in the pay roll. The incinerator at San Francisco is the only one in the United States burning garbage and refuse without other fuel than the material itself. No artificial fuel of any kind can be used here; there is no place for it. All the other cities in the United States, incinerating garbage and refuse, have to use either coal, coke, wood, oil, or gas. Several of the English systems claim to burn without fuel, but in all of them it has been found necessary to use more or less fuel for the purpose of forcing a draught by means of a fan, which is not in use in the San Francisco works.

Since the work commenced in November the fires have never been extinguished; no repairs have been needed, but constant improvements are being made by the company in labor saving apparatus and in increasing the commercial value of the residuum. The works were built originally on low-lying ground covered at certain seasons of the year with water to a depth of from 2 to 3½ feet. The company has been using its ashes and clinker up to this time to fill in its own land and contiguous blocks, and it has found that, for the purpose of filling, the residuum has no superior; but the company is now about to erect fertilizing works, using its ashes as a base, and it is also considering the advisability of erecting works for the converting of the clinker into bricks and mortar. These experiments are being watched with much interest. The premises are kept in a neat and orderly manner. When the furnaces are charged at night, the material brought during the day has been wholly disposed of. There is an entire absence of smell and gases. Sanitary engineers from all parts of the country have visited this plant during the eight months it has been in operation. It has been indorsed highly by the State Board of Health of California and the San Francisco Board of Health, and the municipal authorities feel as if they had at last reached a solution of a sanitary disposition of the city's wastes.

METAL PICKINGS TAKEN FROM REFUSE.



CHIMNEY, SANITARY REDUCTION WORKS.

A SECTION OF THE INCINERATING FURNACE.

RAGS, BOTTLES, ETC., TAKEN FROM REFUSE AND PACKED FOR TRANSPORTATION.

"Magic" and the New Journalism.

Our esteemed contemporary The Evening Post recently published an article entitled "Running a Yellow Journal," which describes how "a great Sunday paper is made," pointing out how facts of all kinds are manufactured by the fertile brain of that mighty man "the Sunday editor." The article goes on to say that it requires no common order of intellect to lay bare the workings of a great stage illusion or the great magician's master trick. It says "that always makes a good story and is a useful one when other topics are scarce. How does the editor manage, when need be, to always expose and confound such frauds as these? Interview the prestidigitateur? Absurd; he might not tell the truth. Send a spy behind the scenes? Impracticable. Out of the depths of his knowledge and in the light of his foresight the Sunday editor buys a book, a large, thick, green book, long published by the SCIENTIFIC AMERICAN, and containing minute description and detailed diagrams of all the tricks and illusions now known to the stage. Whenever it is desirable to warn its readers against impositions of this order, the yellow journal has but to turn to the book, pick out a particularly flagrant illusion, and there it is simply waiting to be exposed."

Biltmore Forestry School.

There is an important forestry school at Biltmore, N. C., which is open to graduates of American colleges and of United States military academies, the idea being to educate the men to be expert foresters. The course began September 1, 1898, and lasts for twelve months. It includes practical instruction in forestry, where the actual work of planting, cutting, road making, etc., is going on. Theoretical instruction is also given, treating the entire subject of forestry, such as sylviculture, forest utilization, forest management, forest finance, forest protection, forest history, fish and game keeping, etc. The school is conducted by Mr. C. A. Schenck, Ph.D., Forester to Mr. Vanderbilt's Biltmore estate.

Miscellaneous Notes and Receipts.

Decolorization of Black Cotton Rags.—Aniline black is justly termed an indestructible color, and cotton rags dyed with it could heretofore only be used for the production of the coarsest wrapping paper. A paper manufacturer has caused chemists to seek a medium decolorizing such rags without weakening the fiber to a great extent. The experiment brought the following result: By the action of bisulphites on such rags, at a high temperature the color changes from black to pale buff. If the stuff, pre-bleached in this manner, is exposed to the successive action of weak acid, clean water, and lime chloride solution, a material of such whiteness is said to be obtained that it can be utilized for writing paper and book paper.—Papierzeitung.

Impregnating Liquid for Incandescent Gas Light Mantles.—According to Invention, M. Salomonov, of Russia, has received a patent on an impregnating liquid for incandescent gas light mantles which effects a coloring of the light. Same consists of magnesium sulphate 12 parts (by weight), zinc sulphate 4 parts, potassium bichromate 1 part, or in its stead ammonium bichromate 1 to 5 parts, dissolved in distilled water 50 to 100 parts. To the solution are added some drops of a silver nitrate solution. The mantles are dipped in this liquid and dried. Such a mantle imparts to the light a pale red color, which can be intensified by the addition of a little stannic nitrate to the impregnating liquid. If an addition of platinum tetrachloride is substituted for the admixture of silver nitrate, the light will have a golden yellow color.—Metallarbeiter.

Important Invention in the Domain of Printing.—According to the Archiv fuer Buchdrucker Kunst, two Englishmen and a Frenchman have succeeded, after many vain attempts, in solving the problem of printing in different colors simultaneously. The process involved deviates entirely from the ordinary method of printing in colors. It is styled the mosaic-chromatic heat process. Neither wooden blocks nor lithographic stones or rollers are employed. The colors required for the picture are applied in any desired number on a plate about three-fourths of an inch thick and form a coherent, cheesy mass. When the arrangement of the colors is finished, the plate presents the aspect of a mosaic picture. The plate is placed on the bed of the machine, an ordinary lithographic press, but adapted to the process, and the impressions are produced by means of a cylinder heated by gas flames in the interior. This invention is of importance, says the said journal, since it affords a saving of 75 per cent of time and wages compared with the old printing method. It is especially suited for colored show cards, for the coloring of maps and plans, and all sorts of illustrations.

To Brown Iron or Copper.—As it is frequently desired to give iron or copper articles a handsome and yet durable brown coloring, says the Illustrirte Zeitung fuer Blechindustrie, for which really good recipes are not at hand, we will give below some directions which have been tried in practice.

The process consists in rubbing the objects with a consistent mass composed of several substances and burning in the applied layer so as to prevent oxidation.

This method finds frequent use on copper ware, not only to avoid oxidation and the tiresome polishing which becomes necessary, but also to impart to the copper, whose natural color is rather glaring, an appearance more pleasing to the eye.

Annealing and careful cleansing with corrosives of the articles have to precede the browning process. A dark brown is obtained by stirring equal parts of verdigris and colcothar (English red) in vinegar to a pasty consistency, applying this on the well cleaned and dried parts, heating to redness, and quickly rinsing off in acetate of copper.

Another mixture which has likewise been found valuable is the following: Make a paste of two parts of finely powdered iron oxide with alcohol. This mass is applied with a brush as uniformly as possible, heat over an open fire, rinse off, and polish with a soft brush.

If the desired effect of the color is not produced thereby, the operation must be repeated.

Lighter brown shades are produced by applying a composition of two parts verdigris, two parts vermilion, five parts sal-ammoniac, and five parts alum with vinegar. After the application the parts are heated and rinsed off.

With the above operations, the greatest cleanliness must be observed, and the touching of portions to be browned with sweaty fingers must be avoided, else spots will result, which can only be removed by taking everything off again.

The process of browning has also found great favor in the manufacture of arms. The barrels of the guns, etc., are, for this purpose, thoroughly polished with emery, cleaned of all adhering grease, and rubbed with the following mixture: Antimony chloride, two parts; crystallized ferric chloride, two parts; gallic acid, one part; water, four parts. This is allowed to dry in a warm place ten to twelve hours; then the article is warmed slightly, rubbed with a woolen rag, and polished with olive oil and wax. This is repeated according to how the color turns out.

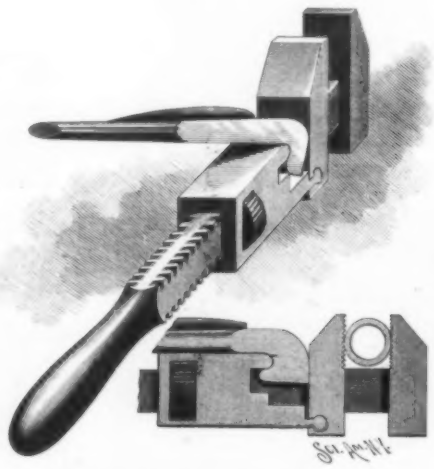
Another good mixture consists of equal parts (by weight) of butter of antimony and olive oil, and one part silver nitrate in 500 parts water, as well as 54 parts blue vitriol, 26 parts alcohol, 14 parts nitric acid, 3 parts iron filings, and 200 parts water.

AN IMPROVED WRENCH.

A wrench has been patented by Charles S. Metcalfe, of Silver City, New Mexico, which provides novel means for obtaining a fine adjustment of the movable jaw in addition to the usual coarse adjustment.

The traveler of this wrench, although operated by the usual nut, nevertheless differs from the travelers of most wrenches in being recessed at its upper end in such a manner that the back portion shall be longer than the front portion. At the end of the long rear portion of the traveler, a cylindrical bearing is provided which is received by a slot in the heel of the movable jaw. By means of this construction, the movable jaw is pivoted on a point remote from the gripping surface, and is carried to and from the fixed jaw by the traveler. A lever is fulcrumed on a semi-cylindrical bearing on the short front portion of the traveler, by means of a hook-shaped head bifurcated to extend at each side of the shank, and provided with a cam-surface at its upper portion and with a connecting straight surface at its upper rear portion. Both cam and straight surface engage the movable jaw.

In using the wrench, the lever is carried out from the shank as shown in the perspective view, the free end of the movable jaw being permitted to drop. When the lever is in this position, the nut is screwed on the shank until the traveler has approached sufficiently near to the fixed jaw to grip the material. By carrying the lever inwardly and parallel with the shank, as



METCALFE'S IMPROVED WRENCH.

shown in the side elevation, the cam-surface of the lever will act upon the free end of the movable jaw, forcing the latter parallel with the fixed jaw, and holding the material in a firm, vise-like grip. When the lever is parallel with shank, the straight upper surface of the lever will hold the sliding jaw in adjusted position.

The Nicaraguan Railway.

United States Consul W. B. Sorsby, at San Juan del Norte, in a consular report to the State Department on the subject of the Nicaraguan railway, now for sale, writes:

I have to report that the railway system of Nicaragua, owned and operated by the government, now offered for sale, was completed in 1885-86 and is in two sections of 58 and 32 miles respectively, with about 3½ miles of side and switch tracks and 4 miles of a branch road recently completed, with further extension of the same under way. It is a narrow-gage railroad. There are three small lake steamers belonging to the system.

According to an inventory taken in 1893, the railway, boats, docks, etc., were worth $1,798,634 (American gold). I am unable to obtain a copy of the inventory so as to show the property in detail; nor can I give exact data as to the freight tonnage, but I estimate it to be, under present conditions, about 60,000 tons per annum, and capable of such increase as the development and improved conditions of the railway system and of the country will warrant.

It is estimated that to put the railway system in good order an expenditure of about $100,000 is necessary, to be used in the following manner: Purchase of 100 box cars at $400, $40,000; three engines at $8,000, $24,000; reconstruction of the Paso Caballos bridge, $12,000; necessary repairs of the track, $24,000; total, $100,000. The gross earnings of the system for nine years, 1886-95, were $2,017,209, and the expenses for the same period $1,438,238, leaving a net earning of $578,971. The average annual gross earnings for the first three years were $159,666, and the average annual expenses for the same period were $94,043. The average annual gross earnings for the following six years were $256,368, and the average annual expenses for the same time were $192,686.

It is well, perhaps, to direct especial attention to the fact that the operating expenses have been allowed to entirely absorb the increased earnings.

The net earnings of $578,971 for the period of nine years indicate a dividend of about 3½ per cent on the valuation of $1,798,634. If this railway system has been able to earn 3½ per cent under government management, subject as it has been to all the harassing incidents of the military exigencies of the country in the last four years (1894-98), due to constantly recurring revolutionary efforts, and finally to the preparations for war with Costa Rica, it should become a most valuable property in the hands of foreigners and conducted according to the American system of railway management.

The government price for the railway system is understood to be $2,500,000; and in this connection it may be well to state that the government owes a foreign debt of $1,400,000, with two years' unpaid interest at 4 per cent; and it is supposed that the desire to pay off this debt is the main object of the government's purpose to sell.

It is believed that the government would award a most valuable concession in order to effect a sale and have the railway system pass under the control of capitalists who would be disposed to improve the present system, and thus aid in the development of the resources of the country. It is thought that, in addition to privileges of the most valuable nature, concessions would be given for the construction of additional railways, either as branches or independent lines, or for an extension of the present system to a point on the Atlantic. For the sum of $2,500,000 cash and a reasonable guaranty to build a railroad from Lake Nicaragua to some point on the Atlantic ocean ("Monkey Point," for instance, a distance of about 80 miles), in order to afford interoceanic communication and transportation, I believe that a perpetual title to the system, 1,000,000 acres of land, to be selected from any part of the public domain, and practically a monopoly of the railroad construction and traffic of the country, would be given.

From present indications it would seem that Nicaragua is entering upon an epoch of peace and prosperity, and that she is eager for the assistance of foreign capital to aid in the development of the country, lavishly endowed as it is with natural advantages—with a climate agreeable and healthy and free from extremes of heat and cold, with a soil capable of the highest state of cultivation and production, with forests of valuable timber, and with fabulous mineral wealth safely hidden from every effort of exploitation except that of capital.

The greatest need of the country to-day is means of reliable and quick communication between the Atlantic Ocean and Lake Nicaragua, to connect with the present national railway system from the lakes to the Pacific Ocean, in order to insure interoceanic transportation.

The construction of the Nicaragua canal would enhance the value of railway properties, because, while interoceanic travel would be lost, this would be offset by the local traffic resulting from the increased tide of immigration.

The system as it exsists to-day, in view of the improvements of the harbor at San Juan del Norte (Greytown) and of the San Juan River, contemplated and even now being vigorously prosecuted by the Caribbean and Pacific Transit Company (the old Atlas Line), will result in an enormous increase in traffic.

The opportunity for investment of American capital is golden, and the influence on commerce between the United States and Nicaragua, with the railway system of the country under the control of Americans, would be well worth careful consideration, not alone as to the gain to the United States, but as to the loss of trade which would inevitably follow if it should be controlled by commercial interests other than our own. These opportunities will not remain open very long; indeed, a strong effort is now being made to secure them by a powerful English corporation.

NEW FRUIT TREE.—A new fruit tree is described by Andrée in the Revue Horticole. The name of the plant is Feijoa sellowiana; it is indigenous in La Plata, South America, but also thrives in Southern France. The tree which blossomed and bore fruit in Andrée's garden attained a height of 3½ meters and had the form of a shrub. The fruit is an oblong, egg-shaped berry 4 to 6 centimeters long and 3 to 5 centimeters wide, retaining its color even in the ripest condition. The meat of the fruit is firm, of white color and sweet taste, containing much juice and giving off an extremely agreeable and penetrating odor. The flavor is said to remind one of the pineapple.

THE PILOTS AND PILOT BOATS OF NEW YORK.

(Continued from first page.)

ship, at the end of which he passes a final examination, in which he must give proof of his knowledge of the management of a square-rigged vessel and of the tides, channels, shoals, points of land and night lights of the locality in which he is to serve. If he is also found to be of good moral character, etc., he receives his "license for piloting vessels to and from the Port of New York by the way of Sandy Hook."

Before the present association was formed each pilot boat worked independently of the others. The laws which regulate pilotage require that the incoming vessel shall take "the first who shall offer himself," and it may well be imagined that there was keen competition between the various boats in the endeavor to sight the incoming vessel and be the first to put a pilot aboard. In the natural order of things the surest way to have intercepted the ships would have been for the pilot boats to cruise a few miles outside of Sandy Hook, where all incoming vessels must pass; but the rivalry between the boats frequently caused them to push out as far as 500 and 600 miles to the east. When a steamer was sighted, there would be a hard race to meet her, and every stitch of canvas was spread that the spars would carry. Speed was of the highest importance in those days, and the boats were modeled and rigged with all the care that is bestowed upon a modern racing craft. They were invariably schooner rigged, and while they could carry a heavy press of sail, they were capable of being quickly made snug under reduced canvas when it came on to blow.

Now it can be understood that while there was unlimited excitement in the old order of things, it must have been both costly and dangerous. The history of those early days of pilotage is full of disaster, and the long cruises to the eastward were as costly as they were unnecessary. This was well understood by the pilots, and it was only a question of time before some arrangement would be made by which the work could be carried on systematically and with less risk and expense. Delegates were appointed from each of the pilot boats (twenty-nine in all), and the Consolidated New York and Sandy Hook Pilots Association was formed. All of the pilot boats were bought by the association, and after the best nine had been selected, the other twenty were sold. This move alone saved nearly $100,000 a year to the association.

The cruising radius of the boats was also reduced to reasonable proportions. Formerly it extended from the capes of the Delaware River on the south to New York and to the east from New York to Halifax; but now the extreme length of the cruising line has been reduced to sixty miles, thirty miles to the southward and thirty to the eastward. The distance is divided into six "stations" of ten miles each, one pilot boat being allotted to each station. At the center of the line, and off the entrance to Gedney Channel, is stationed the "New York," a new steam pilot boat built specially for the association. She is known distinctively as the "station" boat, and while she does her share of the work of placing pilots on incoming vessels, she also takes off pilots from the outgoing ships, her position, about three miles outside of Sandy Hook, placing her directly in the way of ships outward bound. A reserve pilot boat is stationed off Staten Island. The boats, it must be understood, do not remain continuously on one station, but move in rotation from station to station. The boats which are farthest to the east or south are naturally the first to sight the incoming ships, and hence they are the first to be depleted of their pilots. As soon as this occurs the boat leaves its station, notifies the other boats, and sails into New York Harbor, anchoring off Staten Island. Meanwhile, the other boats move out one station, leaving the station next the "New York" vacant. The latter station is taken by a boat from Staten Island with a full complement of pilots, which leaves the island on the return of the empty pilot boat. The pilots are divided into companies of seven men each, and to each boat are assigned three companies, whose round of duties is as follows: One company is engaged in service on the pilot boats at sea, another in piloting ships out of the harbor, and a third in waiting at the headquarters of the association until the boat returns empty to Staten Island. It will thus be seen that there is a constant rotation of the boats and the pilots, each sailing boat making the round of four stations (the fourth being the relieving station off Staten Island), and the pilots, by companies, being engaged in piloting ships in, taking other ships out, or waiting in the office at 24 State Street, New York. The station ship "New York" does not take part in the rotation of the pilot boats, but keeps the same station continuously, running into New York for coal and water once in every fortnight.

The pilot boats, as we have said, are very handsome vessels, built of the best selected materials and heavily sparred. Of this type was the famous schooner "America," which in the fifties crossed over to England and captured the cup which has caused in later years such keen international rivalry in yacht building. The cost of a first class boat ran as high as $15,000, this being the contract price of the "Joseph Pulitzer," which was built in 1894 and was subsequently offered for sale at $7,000, when it was decided to sell off the greater part of the fleet. The dimensions of this boat were: Length, 78 feet; beam, 22 feet; depth, 9·4 feet; tonnage, 76·85. The "R. K. Fox," built in 1876, was 65 feet long, 20 feet in beam, and 7 feet in depth, with a tonnage of 47·68. The boats were designed to be easy in a seaway and when lying to in rough weather. In fair weather, with everything set, the best of them are capable of a speed of 12 knots, while the average speed is about 10 knots. When cruising over their allotted station of ten miles of water, they generally have the four lower sails up and jog along at about 4 or 5 knots an hour. When the weather is too rough to maintain station, the steam pilot boat takes the place of two sailing boats off the lightship and all the other boats run inside for shelter.

The "New York" is under a penalty to the commissioners of $100 if she is not on station, and she is supposed to, and actually does, remain at sea in every possible kind of weather. To this end she has been designed on the general lines of a lifeboat. She can work with either bow or stern to sea, her freeboard is unusually lofty, and she draws an unusual amount of water. Forward she is provided with a turtle-back to throw off the heavy seas that may come aboard. She is also provided with bilge keels to prevent her from rolling excessively. When it comes on to blow unusually hard, the "New York" steams between the Scotland Lightship and Sandy Hook Lightship. The vessel was designed by A. Cary Smith, who is responsible also for the design of many of our finest yachts, and those who are familiar with the latest fashions in yacht designing will see that the "New York" embodies some of the best features of this class of vessel. The dimensions of the vessel are as follows: Length on the water line, 140 feet; length over all, 155 feet; beam, 28 feet; draught, loaded, 14 feet. On these dimensions she must carry coal, water, and stores for one month, and provide accommodation for fifty men. The forefoot is considerably cut away, and the screw is placed much further forward than usual and is deeply immersed, an arrangement which prevents "racing" and contributes to quick steering and general handiness. The bow projects well over the water and the counter is carried down to the water line, which renders her ends very buoyant and enables her to back and go ahead against any sea that may be running. The keel is built on the trough principle and is fully two feet in width. The 100 tons of coal are carried at about the middle of her length, between the engines and boilers, immediately forward and aft of which are placed the large water tanks. The distribution of weights is such that her trim will be the same whether she is loaded or light. She carries two deck houses of steel, the forward one containing the captain's and mates' rooms, the officers' mess and the galley, the after one being a large smoking room. Abaft the boiler casing is a large hoisting engine, which is capable, by means of swinging booms, of hoisting two boats at once from or into the water.

Below deck there are two large saloons and twelve staterooms. A passage along the sides allows communication between the forward and after accommodation without going on deck, so that at all times during the heaviest gales that blow the pilots may remain snugly housed below. This handsome craft is furnished with "all modern improvements," including hot and cold running water, electric light, bathrooms, etc. Motive power consists of a compound engine, with cylinders 26 and 48 inches in diameter by 30 inches stroke, developing 800 horse power. Steam is furnished by two single-ended Scotch boilers, each 10½ feet in diameter by 11 feet in length and containing two furnaces. Working pressure is 110 pounds per square inch. The total cost of the "New York" was $85,000.

It can readily be understood that, taking it all in all, the pilot's life has taken on more comfort and lost much of its peril since the changes above outlined have been introduced.

One of our illustrations shows the method of exchanging signals by night. The incoming steamer shows its position by burning a blue light. The pilot lays his white sails broadside to the offshore horizon and shows his position, or distinguishes himself from surrounding craft by burning a "torch" or "flare-up," which is simply a wad of oakum or cotton waste on an iron handle, dipped in oakum or cotton waste. A view of pilot boats on the distant horizon by night when they are signaling, presents a weird and striking effect, the white sails flashing out and disappearing as if great fireflies were sporting on the waters.

THE Canadian Mining Annual shows that mining enterprises in Canada are on the increase. The geological survey places the total value of the mineral output for 1897 above $28,000,000, or an increase of $6,000,000 over the previous year. The output is divided as follows among the principal mining provinces: British Columbia, $10,455,268; Nova Scotia, $6,000,000; Ontario, $5,000,000; Quebec, $2,063,266; Northwest Territories and Yukon, $3,000,000.

Science Notes.

Repeating prescriptions cause much trouble in many sections of the country. In India few doctors hand the prescription to the patient. The document is sent directly to the druggist, who never thinks of refilling it for a customer unless so ordered by the prescriber.—Phil. Med. Jour.

An anthropologist named Ammon, says the Medicinisch-chirurgisches Central-Blatt, makes the statement that Bismarck's brain was probably the heaviest on record. He judges from measurements of Schäfer's bust of the great chancellor that his brain must have weighed 1,867 grammes (over 58 ounces). Cuvier's brain weighed 1,830 grammes; Byron's, 1,807; Kant's, 1,650; Schiller's, 1,630; and Dante's, 1,420. The average for a well built European adult man is given as 1,380 grammes.

A scientist looking for microbes says there are absolutely none on the Swiss mountains at an altitude of 2,000 feet. Here is the place for the purity party and scaremongers who are forever horrifying the public with the dismal fear of microbes. They would have to take their supply with them, most of which are useful to man. It is pleasing to observe that the microbe does not give himself lofty airs, but, as a fellow creature, comes down to our level and dwells cheerily in our midst.—Meehan's Monthly, from Revue Scientifique.

Hydrogen cooled to —205° and under a pressure of 180 atmospheres is allowed to escape rapidly through a coil of tube into a vacuum vessel, doubly silvered and surrounded by a vacuous space maintained below —200° C. About 1 per cent of the gas is obtained in the form of a clear, colorless liquid showing no absorption spectrum, and with a well-defined meniscus and apparently high refraction and dispersion. A glass tube closed at one end plunged into it becomes filled with solid air. Helium is similarly condensed to a liquid.—J. Dewar (Comptes Rendus, 126, pp. 1408–1412, 1898.)

Miss M. A. Ellis contributed a paper to the British Association on the human ear as a means of identification. She pointed out that the helix, or outer rim of the ear, and the general shape of the pinna, or whole outer ear, were the most useful for purposes of identification. Ears do not change shape after childhood, although they enlarge slightly after middle life. From the varieties of 64 pairs of ears, many belonging to individuals noted in art, science, and literature, printed from life by Miss Ellis, it has been found that the right and left of each pair of ears usually vary in shape.

The balloon used by Messrs. Spencer and Berson, of the Berlin Observatory, in their sensational balloon ascension in London recently, was inflated with pure hydrogen, instead of coal gas, and reached the remarkable altitude of 27,500 feet—more than five miles from the surface of the earth. This record has only once been exceeded, in 1862, by Glaisher and Coxwell, who claim to have gone 1,500 feet higher. Allowing, however, for the superiority of modern recording instruments, and the extreme debility which overcame the two aeronauts even at the lower level, there may be some reason to question whether Coxwell and Glaisher's altitude was actually reached.

An editorial writer in The Sun gives the Surgeon-General's estimate of the number of deaths from disease up to the present time as about 1,500, or only about three-fifths of one per cent, in a total force of about 250,000 men. He cities a Konversations-Lexicon published in Leipsic—Brockhaus', we presume—as stating the loss of life from disease in the German army during the Franco-Prussian war to have been nearly two per cent. A French medical authority, Dr. Cheun, according to The Army and Navy Journal (also cited by The Sun's writer), gives the number of "sick and frostbitten" in the French army as 339,421. The Hispano-American war has lasted thus far about five months. The Franco-Prussian lasted about seven months. The advantages of the Germans in being thoroughly prepared, the writer thinks, go far to neutralize this disparity of duration.

A very interesting application of telegraphy, as carried out by means of Hertzian waves, has lately been tried in Dublin. During the races of the Royal Alfred Yacht Club the proprietors of The Dublin Daily Express were able to receive their dispatches by means of this system. Mr. Marconi, who conducted this operation, followed the racing yachts in a tugboat, in the cabin of which was the necessary apparatus used in transmitting the messages. An observer stationed on the bridge signaled the progress of the race, and Mr. Marconi transmitted the report to land. The messages were received by a subordinate at Kingston, a distance of some five or ten miles from the point of transmission, and from there were telephoned to the journal. All the messages were received in the space of a few minutes after they were sent, and were published in subsequent issues of the paper. The transmission was accomplished without a single hitch, and none of the messages required repeating, the apparatus working satisfactorily throughout.

THE LAUNCH OF THE FIRST CLASS BATTLESHIP "ILLINOIS."

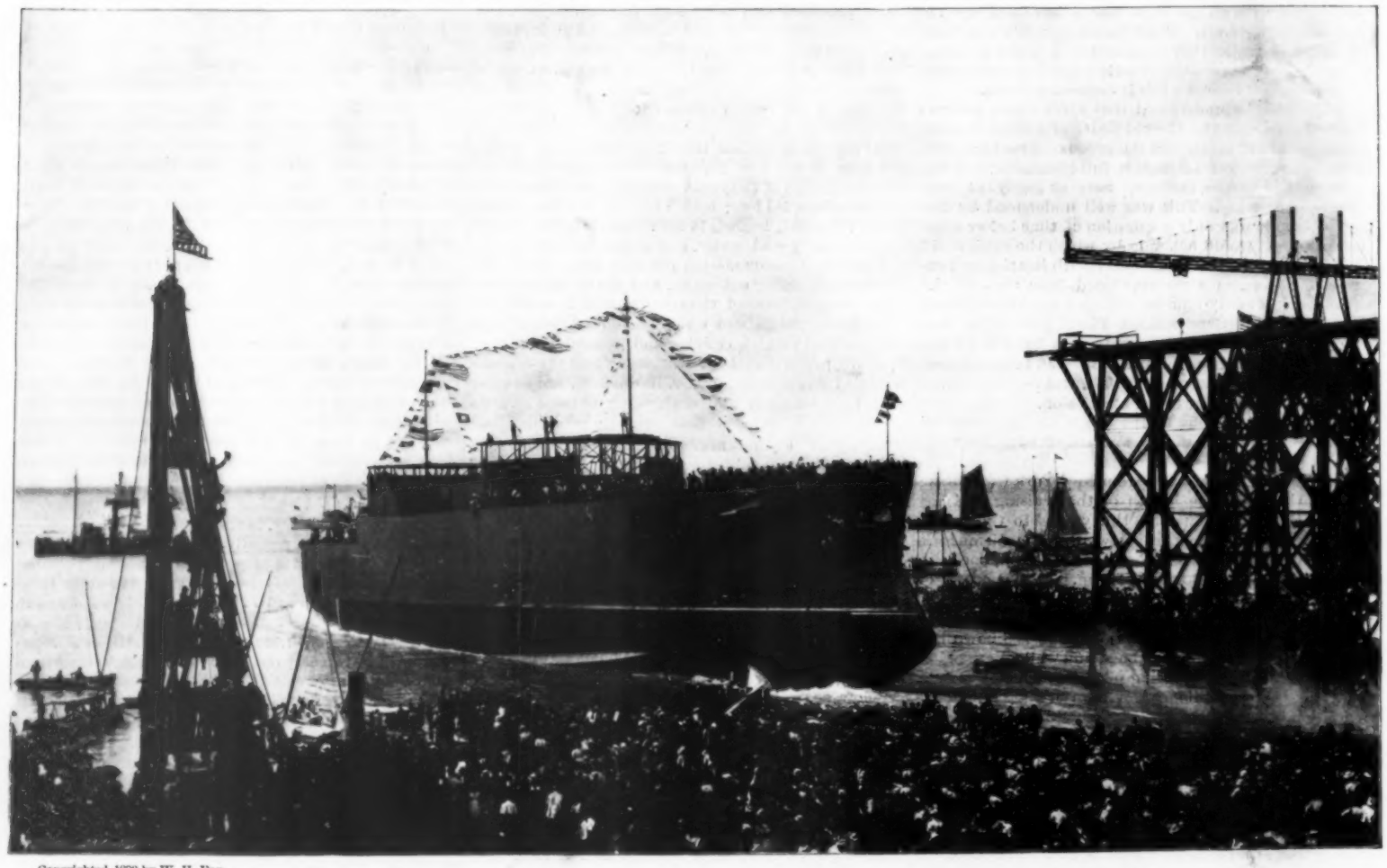
In our last issue we gave some notice of the "Illinois," comparing her with the "Oregon," at present the most notable battleship in commission in our navy. In the current issue we are enabled to present our readers with a view of the launch of the "Illinois," which is reproduced from a photograph taken just as the ship left the ways. The photograph will assist the reader in forming a clear idea of the disposition of the armor upon and within the vessel.

The "Illinois" has a belt of Harveyized armor of a maximum thickness of 16½ inches, which extends in the wake of the machinery spaces and is carried forward continuously up to the stem. It is 7½ feet in depth, 3½ feet of it at the normal draught of the vessel being above the water line and 4 feet below it. At the time of the launch this armor was not in place, and the "shelf" upon which it rests can be clearly seen in the engraving. The point aft at which the belt terminates is indicated by the offset (seen in shadow in the engraving) near the stern, and its top edge at the bow is shown by the offset in the curve of the stem, which is also discernible in the engraving. The forward turret for the 13-inch guns will be located above the spar deck, on which the workmen and guests at the launching are gathered. Four of the battery of fourteen 6-inch rapid-fire guns will be located on this deck, the ports for two of these guns being located where the plating of the superstructure on the starboard side of the vessel is shown cut away. The other ten guns will be located on the main deck immediately below the spar deck. Two of these will be placed forward, firing through ports on either bow, one of which is shown in the engraving. Each of these gun positions, as well as those of the four guns on the spar deck, will be protected by six inches of reforged Harveyized steel. On the main deck amidships and between the 13-inch turrets there will be eight 6-inch rapid-fire guns, four on each broadside. It will be noticed the ports for these four guns do not appear in the engraving, and this brings out a fact which will be of interest to those who are not acquainted with the methods of warship construction, namely, that it is customary to carry up the side plating of the hull complete and then cut out the necessary ports afterward.

The long spear-shaped piece of metal which is noticeable at the water line is one of the bilge keels, which are deep plate steel projections that are built out from the bilge of the vessel for the purpose of preventing her rolling. Previous to the introduction of the bilge keel, battleships were proverbially heavy rollers. Those who follow naval matters with interest will remember the case of the "Retribution," one of the first of the 14,000 ton battleships of the British navy, which rolled so heavily in a beam sea in the Bay of Biscay (the maximum roll being 45°) that her captain put back in alarm to Plymouth. The trouble was remedied by the insertion of bilge, or rolling, keels, as they were then called, and the angle of roll was reduced to from 12° to 15°. We had a similar experience with our own "Indiana," which rolled in a heavy sea to such an extent as to break loose her 13-inch turrets. Bilge keels were added to this ship and the vessels of her class with the same excellent results in stability.

One excellent feature of the "Illinois" is the extraordinary amount of armored area which she presents against the shells of the enemy. Not only is there a heavy belt of armor for nearly three-quarters of her length at the water line, but the hull is further protected above this main belt by a supplementary belt of lighter armor 5½ inches in thickness which extends from the top of the armored belt amidships throughout the height of two decks. This armor extends from barbette to barbette and it ends in diagonal bulkheads which rest upon the 12-inch bulkhead that extends across the ship and joins the armor belt with the barbettes. Immediately inside the 5½-inch armor, and carried well forward and aft, are coffer dams 3 feet wide and 3 feet in height, the top of which is 6 feet above the mean load water line. These coffer dams are closely packed with corn pith cellulose. It can thus be seen that the central portion of the ship is completely shut in by an unbroken wall of armor, which extends from 4 feet below the water line to the level of the spar deck, a vertical height of about 23 feet; moreover, in no part are these walls less than 5½ inches in thickness. When we remember that 5½ inches of Harveyized steel is sufficient to burst all but the largest shells on the outside of the ship it is evident that in the new battle ships our gunners will have very excellent protection.

A comparison of the "Alabama" with the "Canopus" type of the British navy shows that in some respects, though they are smaller, our ships are superior, while in others they are not so formidable. Exclusive of the horizontal deck the total weight of armor carried by the "Alabama" class is 2,000 tons, which is considerably in excess of that carried by the "Canopus." This is remarkable when we bear in mind that the displacement of the "Canopus" is about 13,000 tons, while that of the "Alabama" is 11,525 tons. If the ship which is 1,500 tons larger is less heavily armored, the question rises, What are the compensating features? To what use is the extra displacement put? It is chiefly devoted to larger coal-carrying capacity, larger stores and ammunition supply, and more powerful engines and boilers. The larger ship, moreover, provides increased accommodation and enables a bigger crew to be carried. The increased ammunition supply of the "Canopus" over the "Alabama" is not very considerable. Her maximum coal supply is 1,850 tons as against 1,200 tons of the "Alabama." Her engine power is 13,500 as against 10,000 of the "Alabama," giving her a speed of 18¾ knots as against 16 knots, and her complement of officers and men is 700, as against 489 for the "Alabama." On the other hand, the "Alabama" possesses marked advantages in protection and the weight of her armament. Her belt varies from 9½ to 16½ inches, whereas the belt of the "Canopus" is only 6 inches in thickness with a 3-inch sloping deck behind it. The armor on the gun positions varies from 5½ to 17 inches in the "Alabama," while in the "Canopus" it ranges from 5 to 12 inches. The maximum thickness of the deck plating in the "Alabama" is 4 inches and in the "Canopus" 3 inches. The "Alabama" carries four 13-inch 60-ton guns and fourteen 6-inch 6-ton guns, against four 12-inch 46-ton guns and twelve 6-inch 7-ton guns for the "Canopus." It is evident that the weights allotted to guns are considerably heavier in the "Alabama." Unfortunately, the "Alabama" will not get the benefit of the improved weapons which are to be mounted on our latest battleships. Her guns are of the older type, and the 13-inch 60-ton weapon has less energy than will be possessed by our new pattern 12-inch gun. The respective speeds of the two ships are as we have said 16 knots for the "Alabama" and 18¾ knots for the "Canopus." It is here, in respect of her comparatively low speed, that any fault can be found with the design of the "Illinois;" and it is satisfactory to know that this defect will be remedied in the "Maine" and her sister ships, which are guaranteed to make 18 knots, and will possibly run up to even 18½ or 19 knots on their trials.



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LAUNCH OF THE "ILLINOIS," OCTOBER 4, 1898, AT THE YARDS OF THE NEWPORT NEWS SHIPBUILDING COMPANY.

Drawing Microscopical Images.

A. H. Smith (Journ. Brit. Dental Asso.) recommends the following method of projecting microscopical images so that they may be traced on paper: The microscope body is placed in a horizontal position and the mirror removed from its substage attachment. The microscope slide having been placed on the stage, the illuminant (lamp light for choice) is condensed on the side by means of a "bull's eye" in the same way as for photomicrography. Care must be taken to center the light. The concave mirror is then attached to the front of the eyepiece of the microscope by a piece of thin wood as a spring, and has its surface at an angle of about 45° with the plane of the anterior glass of the ocular. The image is thus projected on the paper beneath. No distortion will occur if the outer ring of light is perfectly circular. A dark cloth, such as photographers use, is thrown over the draughtsman's head, and also the body of the microscope, and all light excluded save that through the microscope lenses. Any section can thus be easily, rapidly, and comfortably drawn, and, it is said, accurate representations of objects magnified up to 500 or 600 diameters can be obtained.

OUR FINGERS AS AN AID IN MULTIPLICATION.

Perhaps one of the most difficult tasks in pedagogy —a task which exacts the utmost patience on the part of both instructor and pupil—is the teaching of the multiplication table. Month after month teachers expend their time and use their skill in demonstrating and explaining by all possible means exactly what the product of two numbers represents. Often enough these efforts have been vainly expended. After the children have apparently mastered those products in which the numbers 7 and 8 occur, they pass to those in which the number 9 figures, and while mastering these, often completely forget the preceding series. As a general rule, the products from 2 to 6 are quickly mastered and easily retained; but in multiplying together numbers greater than 6, the child proceeds slowly. Beyond 12, even adults find mental multiplication difficult, and resort to pencil and paper.

A Polish mathematician, named Procopovitch, has given his attention to this matter of multiplication and has invented a system which, for ingenuity and simplicity, leaves little to be desired. Procopovitch had often noticed that children used their fingers in mathematical computations which were at all difficult to them, and hence devised a method of manual multiplication that has been successfully used in many European schools. Procopovitch's system neglects all products involving numbers less than 6, because, as we have already observed, these products are readily learned by most children.

The Polish mathematician first numbers the fingers of each hand. The two thumbs each represent 6, the index-fingers 7, the middle fingers 8, the ring-fingers 9, and the little fingers 10. In order to multiply any two of these numbers, the fingers representing the multiplier and the multiplicand are placed end to end. Beginning with the fingers which have been thus placed together, the number of fingers is counted, proceeding toward and including the thumbs. The sum will be the number of tens contained in the desired product. Below the fingers which have been joined, a certain number still remains. The fingers remaining on the one hand, multiplied by those left on the other hand, will give the number of units, which, being added to the tens, gives the desired product. For example: Suppose that 8 is to be multiplied by 9. The middle finger of the right hand is placed against the ring-finger of the left hand, as shown in Fig. 2. Counting the number of fingers above those which have been placed together, including these, seven fingers, representing 7 tens or 70 in the product sought, are obtained. There still remain on the right hand two fingers, which, multiplied by the one finger remaining on the left hand, give 2 as the number of units. These two units added to the tens already obtained give 72, the product of 8×9. It is, of course, immaterial on which hand the multiplier or multiplicand is taken.

If it is desired to multiply 7×9, then the same method is employed, the index-finger of one hand being placed against the ring-finger of the other hand, as shown in Fig. 3. Counting the number of fingers above those placed together, and including these, 6 tens or 60 will be obtained. Multiplying the three fingers remaining on the right hand by the one left on the other hand, 3 units are obtained, which, added to the 6 tens, give 63 as the product of 9×7 or 7×9.

If it is desired to multiply 6×6, the two thumbs are placed together as shown in Fig. 10. The two thumbs represent here only two tens in the required product, there being no other fingers above those joined. Multiplying the four remaining fingers on the one hand by the four on the other, 16 is obtained. This added to twenty gives $20 + 16 = 36$, the product of 6×6. Figs. 1 to 10 inclusive represent the multiplication of various factors in the series.

The Polish mathematician does not stop here, but extends his system to numbers greater than 10. In the old method, the multiplication of factors composed of two ciphers involved difficulties which, as we have already observed, could be overcome only with the assistance of pencil and paper. In this system of manual multiplication these obstacles are easily surmounted and the results obtained are in every way as remarkable as those already described. In the first series, comprising numbers of two ciphers, the thumb represents 11, the index-finger 12, the middle finger 13, the ring-finger 14, and the little finger 15. When multiplying one number by another, the fingers representing the respective factors are placed together as before. The number of fingers above those joined, including these, will in this case also indicate a certain number of tens. The lower fingers are, however, entirely neglected. In order to obtain the number of units, the fingers which have already given the number of tens are again taken, the number on the one hand being multiplied by the number on the other hand. The product thus obtained is increased by 100 and the sum added to the number of tens. Suppose that 13 is to be multiplied by 14. As indicated in Fig. 11, the fingers representing these numbers are joined. Counting the number of fingers above those which have been placed together, including the latter, 7 tens or 70 are obtained. Taking these same fingers again and multiplying the number on one hand by the number on the other hand, the product 12, representing the number of units, is obtained. Adding to this the constant 100 and the number of tens, there results $70 + 12 + 100 = 182$, the product of 14×13.

Another method could be employed which, although it would lead to the same result, is not so simple. In this second method, the fingers above those which have been joined, including the latter, represent the number of twenties. In Fig. 11, for example, there are on the right hand three fingers and on the left hand four fingers, giving 7 twenties or 140. The remaining fingers, three in number, represent the number of tens, and in this example are equal to 30. Finally the four fingers on the left hand, representing the twenties, multiplied by the three on the right hand, also representing the twenties, give 12 for the number of units. Adding, there results $140 + 30 + 12 = 182$.

In multiplying two numbers each of which is greater than 15, a new series is employed extending from 16 to

Fig. 1.—Multiplying 9×9.

Fig. 2.—Multiplying 9×8.

Fig. 3.—Multiplying 9×7.

Fig. 4.—Multiplying 9×6.

Fig. 5.—Multiplying 8×8.

Fig. 6.—Multiplying 8×7.

Fig. 7.—Multiplying 8×6.

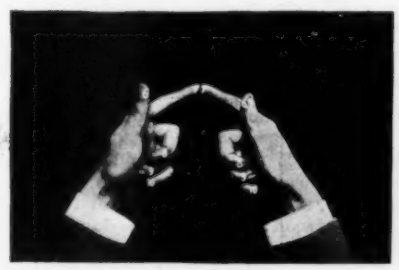


Fig. 8.—Multiplying 7×7.

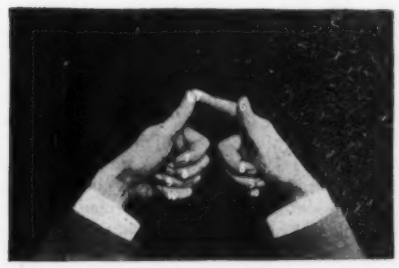


Fig. 9.—Multiplying 7×6.

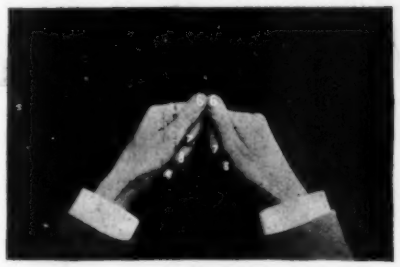


Fig. 10.—Multiplying 6×6.

Fig. 11.—Multiplying 14×13.

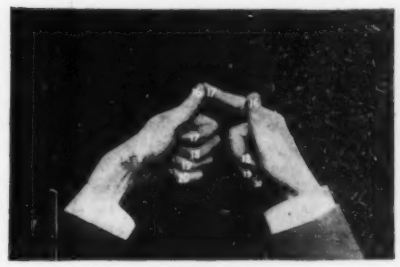


Fig. 12.—Multiplying 16×17.

RAPID METHOD OF MULTIPLICATION WITH THE FINGERS.

20. In this series the thumb represents 16 and the little finger 20. The fingers placed together added to those above give the number of twenties. The constant to be added in this case is 200. If it is desired to multiply 16 by 17, a product not readily obtained by mental calculation, the fingers representing the factors are joined as indicated in Fig. 12. The thumb of the left hand, representing the multiplier, being placed against the index-finger of the right hand, gives, with the remaining thumb, 3 twenties or 60. The four fingers remaining on the left hand multiplied by the three lower fingers on the right hand give as the number of units 12. Adding to this product the constant 200 and the number of twenties, there results 60 + 12 + 200 = 272.

In this manner the series can be extended indefinitely, the only condition to be observed being that the multiplier and the multiplicand should be members of the same series of five numbers. The entire system of manual multiplication rests on this condition.

SPIRIT SLATE WRITING AND KINDRED PHENOMENA.—III.

BY W. E. ROBINSON.

We will now describe a trick which is performed with the aid of two double slates, either tied together or riveted at the corners. They are, of course, brought to the medium by the unbeliever. Both the medium and the stranger sit at the table, and the slates are held under it, the medium grasping one corner and the skeptic the other corner, each with one hand, and the disengaged hands are clasped together above the table. After a time the slates are laid upon the table, the string is untied and the slates are taken apart, but no writing is found. The medium states it must have been because there was no slate pencil, and when a small piece of pencil is placed between the slates and they are again tied with a cord by the medium, he again passes them under the table, both persons holding the slate as before. Presently writing is heard, and, upon the skeptic bringing the slates from under the table and untying the cord himself, he finds one of the slates covered with writing, though but shortly before they were blank. The explanation is simple; the medium does not pass the slates under the table the first time, but drops them in his lap with the side where the string is tied or knotted downward, and really passes a set of slates of his own for the skeptic to hold, the medium supporting his end by pressing against the table with his knee, which leaves his hand disengaged. He now covers the face of the slate which is uppermost in his lap with writing, doing so very quietly and without noise. As he brings the slates above the table he leaves his own in his lap and brings up the skeptic's with the writing side down. The slates are untied and taken apart and shown devoid of writing on the inside, which he claims was caused by not having any pencil inside. The medium now places the pencil upon the slate which was originally the upper one, covers this with what was the bottom slate, which is covered with writing inside on the back or bottom of the slate. This action brings this slate on top, with the writing upon its inside. The slates are again tied together, and, in doing so, the slates are turned, bringing the slate containing the writing upon the inside at the bottom, instead of the top; the string is tied or knotted above the top slate. Of course, when again separated, the writing is found upon the inside of the lower slate. When the slates are passed under the table the second time, the spectator himself is allowed to do this, and the medium with one of his finger nails, while holding his end of the slate, produces a scratching noise on the slate, closely resembling the tracing of a pencil. The slates may be held above the table the second time if preferred.

In case two slates are brought which are riveted or screwed together, another method must be employed. The slates are held under the table in the same manner as in the previous tests; the medium is provided with a hardwood wedge and a piece of thin steel wire at one end of which is attached a tiny slate pencil. An old umbrella rib is sometimes used, as it has a small eye at the end through which the pencil is forced. The wooden wedge is pushed between the wooden frames of the slates at each side. The frames and slates will give enough to allow the wire and pencil to be inserted and writing being accomplished with it, after which the wire is withdrawn and then also the wooden wedge. All this is done without leaving any trace or mark behind it. (See Fig. 7.)

Another method of slate writing was performed by a prestidigitateur, but the means employed belong rather to the conjurer than to the spiritualist. This called for the placing of a slate on a table, and, while the committee held their hands upon the slate, the sound of writing was heard, and in a few moments a message was written upon it. The table had a double top, with room enough to conceal a small boy. There was a neatly made trap beneath the table cloth and the top of the table, the cloth being glued around the opening to keep its place. The trap door opened downward, and the boy concealed in the table opened it and did the necessary writing on the slate and again closed the opening. This idea was improved upon by doing away with the boy and the double-top table. The writing was then done with the lights turned down low, and the medium introduced his hand under the table, opened the trap and did the writing, and shut the trap before the lights were turned up. The medium and the committee sat around the table with their hands resting on the slate and each person's hand touched that of his neighbor, so that neither could move without the other being aware of the fact, but the medium's right hand neighbor was a confederate.

Another method of producing writing upon the inside of two slates sealed together is as follows: The table is the same as that previously described. The slates are two single ones hinged together and sealed around the edges in any manner the committee may see fit. One of the slates is a trick slate; the slate itself working on a pivot or hinge along one of its

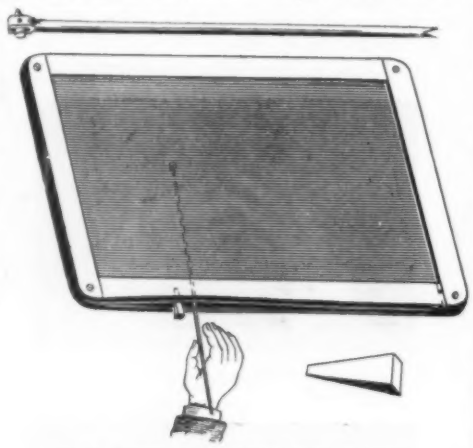


Fig. 7.—WEDGING APART THE SLATES.

sides. (See Fig. 8.) A catch is concealed in the frame of the slate which releases the slate proper and allows it to drop down on its hinge or pivot, so that when the slates are placed on the table they are put directly over the trap on the table, with the hinges of the two slates toward the medium. The medium releases the catch, which allows the underneath slate to drop as far as the table and, when the trap in the table is open, the slate drops with it far enough for the medium to write on that part, also on the slate above it. He then closes both the slates and the trap in the table, and the slates, upon being unsealed, are found covered with writing.

The only thing which now remains to be explained is how the medium gets his hand free to do the writing without being detected. The lamp or gas jet is close to the medium's right hand, where he can reach it. Now all the persons are seated around the table with their hands on the slates, and their hands or fingers touch one another. The medium, taking his right hand away, turns down the light, and his next door neighbor, as soon as the light goes down, feels his, the medium's hand or finger, replaced; at least so he thinks. What really happens is this: The thumb of the medium's left hand is stretched far enough over to touch the hand or finger of the person sitting on the per-

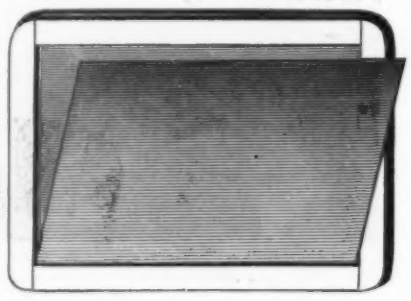


Fig. 8.—THE TRICK SLATE.

former's right hand side. The medium now produces the writing, and when finished, as the gas turns up, he removes his left thumb to create the impression that he has just taken his right hand away for the light. The same trick may be performed above the table on an ordinary slate.

Evils of the Match Industry.

In the manufacture of the ubiquitous match, as is well known, the use of phosphorus entails many miseries and discomforts upon those engaged in the manufacture, they being mostly women and girls. Existing lesions of any kind are thereby likely to become aggravated, owing to the fumes of phosphorus that arise from the "dipping" trough, fumes that are highly irritating to eyes and throat, to lung tissue, and that, by permeating the cavities of the teeth, frequently provoke carious disease of the jaw, leading to hideous deformities, perhaps even to fatality.

Recently attention has been called to the conditions existing in the match factories of Great Britain, and an investigation revealed such a deplorable state of affairs as led to memorializing the Home Secretary. How far these or similar conditions may obtain in the United States and Canada is not known, and perhaps would be difficult to determine, since the "hands" are constantly entering and going or shifting. Further, ordinary commercial ("stick") phosphorus is now very little employed, thanks to the demand for the "parlor" match, which requires the amorphous variety, which is nearly odorless, gives off little fumes, and is but slowly and with some difficulty absorbed by the human economy. If handled with ordinary precautions, amorphous phosphorus is scarcely at all objectionable or dangerous; but, unfortunately, the average employe is apathetic as regards self, and not at all inclined to adopt measures that entail extra care or labor.

Abroad the demand for cheap matches, regardless of character or composition, is much greater than in the United States, and antiquated and cheap methods generally obtain. "Stick" phosphorus continues to be used to a degree not known for many years on this side of the Atlantic. On the Continent of Europe, generally, however, the governmental paternalism is such that it is possible to throw certain safeguards around factories and employes such as would not be tolerated in English-speaking countries. In France and Belgium, for instance, as well as Germany, Sweden, and Norway, certain stringent rules are formulated, that not only must be printed in large and legible type, and posted conspicuously everywhere throughout a plant, but are required to be read as often as once each week to the employes. Further, dining and lunch rooms are provided in connection with every establishment, along with suitable clothing and retiring rooms, lavatories, etc. It is enjoined that no food or drink be brought into the building, except as provided for by the management; consequently, eating and drinking in the workshops are prevented. Even the chewing of gum is prohibited. Before partaking of any meal, and prior to leaving the factory at the close of the day, each individual is required to doff his or her working clothes, and put on uncontaminated garments; the hands must be thoroughly cleansed by means of soft soap and water; the finger nails duly attended to; teeth cleansed, and mouth and throat washed with a gargle specially provided, all of which is enforced by rigid inspection.

Each person seeking employment, moreover, is carefully subjected to examination by the medical officer of the company, who rejects all under sixteen years of age, all possessed of bodily infirmities of any kind, even to a sore or abrasion or slight defect in dentition, or who are "delicate" or anæmic; all must either have been vaccinated or have secured immunity through smallpox. With the first evidence of illness, regardless of source or character, the employe is suspended, but allowed to draw two-thirds wages until fully recovered.

Such procedures, aided by efficient methods of ventilation, have materially lessened the accidents that commonly accrue to the match industry. Among the six hundred people employed in the Pantin and Aubervilliers works in France, despite the use of "stick" phosphorus in "dipping" mixtures, there was not a single untoward result chronicled during 1896 or 1897, which may be considered phenomenal.

For some years the French government has sought newer and more effective and safe methods of match manufacture, and it is constantly, by subsidies, fostering investigations along these lines. The demand of the hour is for a match that will ignite anywhere by friction, that will be free from phosphorus, and that can be manufactured cheaply. The two first desiderata have been worked out, but thus far are effectually handicapped on the score of economy of production. It would seem as if a few hints might be had from Japanese sources. In the "Eastern Insular Empire" a great variety of matches are made, some unique, some startling in the results produced, some from paper, some that ignite without flame, yielding only a coal of fire that persists for several minutes and suitable for the pipe; but their production is in the hands of guilds, who guard their secrets most jealously and who as yet have made no organized attempts at exportation.

The so-called safety match is made with amorphous phosphorus, which also, to insure better ignition — though it should not—appears in the prepared surface that adheres to the container. The "safety" element, moreover, is somewhat delusive, since the sparks that attend the ignition fly to considerable distances, and may be—and often are—sources of small fires or even conflagrations. Neither is the prepared surface essential, since these matches may be readily "struck" by passing quickly and lightly over a smooth, dry surface, such as plate glass or polished marble, wood, or metal.

LIGHT is diminished by the interception of glass, as follows: British polished plate, ¼ inch thick, 13 per cent; rough cast plate, ¼ inch thick, 30 per cent; rough rolled, ¼ inch thick, 53 per cent; sheet glass, 32 ounces, 23 per cent.

SAN MARINO, THE SMALLEST INDEPENDENT REPUBLIC IN EUROPE.

Few visitors to Italy ever make the excursion from Rimini to San Marino, the smallest independent republic in Europe, although it is one of the most curious places in Italy, if not in Europe, for it has maintained itself as a republic ever since the earliest times of Christianity. San Marino, which has an area of 33 square miles, lies between the provinces of Forli and Pesaro-Urbino, and is thus entirely surrounded by Italian domains. It is situated on part of the eastern spurs of the Apennines. Monte Titano, the central and culminating summit, has three peaks, each surmounted by a castle, as shown in our engraving. The coat of arms of the republic is three feathers, which seem to have been suggested by these rocky summits with their fortresses. The city of San Marino has 1,600 inhabitants out of the 8,000 of the republic. It is one of the most picturesque places in the world, being perched on perpendicular cliffs; and when we look at them we can then understand that the extraordinary mountains and rocks introduced into the backgrounds of the paintings of Perugino, Raphael, and other Umbrian painters were not nightmares, but were really taken from nature. Borgo di San Marino, at the foot of the cliffs, is the commercial center of the republic, and here we first find the money coined by it. A steep path leads up to the picturesque Città, to which we have already referred. From the castle there is a magnificent view of the Adriatic, and even on a clear day the coast of Dalmatia may be seen. It is said that when the mail arrives at Borgo a bell is sounded, and those who live on the cliffs have to descend to get their mail, if they wish it; for, owing to the primitive state of affairs, the postman never ascends the rock.

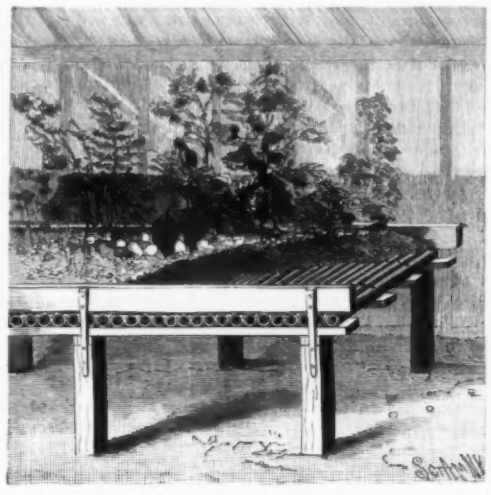
It may well be asked how it is that such an anomaly as the microscopic republic is allowed to exist in the heart of a monarchy. The history of San Marino is an interesting one. The first authentic document dates from 885. The inhabitants purchased territory from neighboring princes and the commonwealth assisted Pope Pius II. (Æneas Sylvius) against the Malatestas of Rimini, and as a reward received three little castles. On the annexation of Urbino to the States of the Church, in 1631, the independence of San Marino was acknowledged In 1797 Napoleon decided to preserve the small republic, and in 1854 Napoleon III. saved it from the designs of Pius IX. When Italy became unified, San Marino obtained excellent terms.

It is governed by a great council of sixty members, twenty nobles, twenty burgesses, twenty rural landowners, named for life by the council itself. From this body is elected the Council of Twelve, which, with a legal adviser, decides all questions. Two captains-regent, elected every six months, represent the state, which has also its home secretary, its minister of foreign affairs, its chancellor of the exchequer, its army of 950 men, and a regular budget. By treaty with Italy, San Marino receives a certain proportion of the Italian customs revenue, but exacts no customs on her borders. She also agrees not to grow tobacco, but is allowed to import tobacco duty free.

In order to avoid copyright difficulties, there is no printing press in San Marino. It is a curious fact that the commissary, or judge, and the physician must both be strangers, and they are paid out of the public purse. Such are a few of the curious facts connected with the smallest independent republic in Europe, or the world, for that matter.

A NOVEL USE FOR DRAIN TILES.

Florists and those who are interested in growing flowers can easily make a tiled bench which possesses



DRAIN TILES FOR FLORISTS' BENCHES.

remarkable advantages over the old soil benches, for if the first cost of the tiled bench is from 25 per cent to 30 per cent greater than the wooden bench, it is a great deal cheaper in the end, and the results are more satisfactory. While the drainage is perfect, still the soil will not dry so completely as with the bench with a wooden bottom. The benches rest on posts placed four feet apart; the cross pieces are two by four inches, and the stringers upon which the tiles rest are also two by four inches. The tiles used may be two or three inch, the two inch being slightly preferable, but the three inch covers so much more space for the same amount of cost that they are much more economical. On these benches five inches of soil is placed, as the drainage is so rapid that this depth can be safely used, and depth is considered desirable where the drainage is such as to warrant it. The tiles are a trifle over a foot long, three lengths being used on a side bench, five lengths being used on a center bench. Occasionally a few of the tiles are broken in changing the soil, but this breakage is so unfrequent that the expense on this account is insignificant. The demand for tiles for this purpose might induce manufacturers to make a special flat, hollow tile for florists' use. If made with plenty of sand in the clay to make it porous, it would make a good bench for flowers and would perhaps be more convenient than drain tiles.

Cost of Rare Metals.

The following shows the cost of rare metals per pound, avoirdupois, says The Mining and Scientific Press:

1.	Gallium	$68,600 00
2.	Vanadium	10,780 00
3.	Rubidium	9,800 00
4.	Thorium	8,330 00
5.	Glucinium	5,800 00
6.	Calcium	4,900 00
7.	Lanthanum	4,900 00
8.	Lithium	4,900 00
9.	Indium	4,410 00
10.	Tantalum	4,410 00
11.	Yttrium	4,410 00
12.	Didymium	4,410 00
13.	Strontium	4,200 00
14.	Arium	3,675 00
15.	Erbium	3,675 00
16.	Ruthenium	2,695 00
17.	Niobium	2,450 00
18.	Rhodium	2,450 00
19.	Barium	1,960 00
20.	Titanium	1,102 00
21.	Zirconium	1,040 00
22.	Osmium	1,040 00
23.	Uranium	980 00
24	Palladium	560 00
25.	Tellurium	490 00
26.	Chromium	490 00
27.	Gold	300 00
28.	Molybdenum	245 00
29.	Platinum	144 00
30.	Thallium	122 50
31.	Iridium	112 00
32.	Tungsten	35 00
33.	Potassium	28 00
34.	Selenium	18 80
35.	Cobalt	8 00
36.	Magnesium	4 50
37.	Bismuth	2 75
38	Sodium	2 50
39.	Aluminum	34
40	Manganese	1 10
41.	Cadmium	1 30
42.	Arsenic	40

Good Advice.

Life is too short and full of care and sorrows for one to be the cause of adding one feather's weight of trouble to another's load. Will Carleton, the poet, in the "First Settler's Story," we believe it was, makes the old man say, in speaking of his wife, that she used to stand around and boss the job, and by her kind words lifted whole tons. Kind words have the same effect the world over. They lift a fellow out of the slough of despond; they break the stiffened, set features of the worried into a pleasant, hopeful smile. And how much better it is to cultivate the habit of treating everyone as though a time would come when we should lay down the mortal form; and that to leave behind a character and reputation of fairness, truth, and honor is the most enduring of riches.

THE SMALLEST INDEPENDENT REPUBLIC IN EUROPE—THE THREE FORTRESSES ON THE THREE PEAKS.

Trade in Farming Implements.

At the close of the civil war a reaper, now selling for $75, cost $120; a steel plow, now costing $12, sold for $26; a potato digger, now costing $7, sold for $25; grain scythes, now costing $9 a dozen, cost $26; shovels, now costing $9 a dozen, cost $20; binders, now costing $130, cost $400; and mowing machines, now costing $50, cost $110. As this process of reduction has been going on, the product of American factories in the line of agricultural implements has been generally extended and vastly improved, so that the United States are now not only at the head of all other countries, but so far at the head of other countries that there has practically ceased to be any serious competition, except in respect to the supplies sold by certain European countries to their colonies. Through the free markets of the world, without restrictions established by governments, the United States are the great source of supply.

The importance of the business carried on both at home and abroad by the United States manufacture of farming implements is shown by the figures of the last Federal census of 1890. There were at that time, approximately, 1,000 manufactories of agricultural implements in the United States, the amount invested in this line of manufacture being nearly $150,000,000, the average number of persons employed in it being 45,000, the materials used averaging in value $30,000,000, and the output $80,000,000.

Since the summer of 1893, the American trade in agricultural implements has been subjected to a marked prostration. The export trade of the country in agricultural implements has continued large and has even increased:

1893 (fiscal year)	$4,657,000
1894 (fiscal year)	5,027,000
1895 (fiscal year)	5,410,000
1896 (fiscal year)	5,176,000
1897 (fiscal year)	5,240,000

The Argentine Republic has been the chief customer of the United States in this item of manufacture, and the South American countries and West Indies have been customers to a smaller extent. But while the foreign market has continued, the home market for American agricultural machinery has been curtailed greatly, in consequence of the failure of some crops, the diminished prices for cereals, the accumulation, West and South, of mortgages and the contraction of credits to farmers, who, as a rule, buy their agricultural machinery on credit, payment being predicated on the success of the crops and of paying prices for them. As a result of the agricultural depression in the West in 1893, 1894, 1895, and 1896, it is hardly too much to say that the farming implements used during the past five years in the United States have been literally wearing out.

The large concerns have been carrying their customers on credit, and, with large debts outstanding, the farmers, generally speaking, have been awaiting the return of better times and better prices. The favorable conditions of a year ago were not without their effect on this branch of business, and those of this year are being reflected in the enlarged market for farming machinery, reapers, thrashers, plows, rakes, binders, scythes, and harrows.

At the head of the States of the country in the volume of its manufacture of agricultural implements is Illinois, with an invested capital of nearly $60,000,000, Ohio follows, then New York, and then Wisconsin. Ohio supplies most of the Southern market of demand, and New York, the Middle, and Eastern States. Of recent years California has developed its manufacture of farming implements largely.

Brick Monuments.

"Brick," an excellent trade journal devoted to the clay industries, recently published an interesting photograph of a monument which seems to open a new future for brick and at the same time will tend to relieve the granite and marble monotony of our cemeteries. The monument consisted of a square pier 33 inches square at the base, 7 feet high, and resting on a base 5 feet square. The pier is built of brown-faced brick with marble trimmings and four marble panels. At the top is a series of steps capped by a marble cover, finished with an urn. The base is built of brown rock-faced brick outside and brown smooth-faced brick inside. A monument of this kind could be easily erected anywhere in the country, and the designs for such monuments would be almost limitless. Of course, a granite or marble monument of considerable size can only be carried to cemeteries and erected with considerable difficulty and expense; so, if for no other reason, the brick monument is interesting on account of the portability of the materials. The enduring quality of brick when properly laid ought to commend the idea at once.

The Current Supplement.

The current SUPPLEMENT, No. 1190, contains a number of papers of remarkable interest. The first in importance is, without doubt, the "Ghost Dance," an article specially prepared for the SUPPLEMENT by Cosmos Mindeleff. It is particularly timely at the present day, as there has been an outbreak by the Indians in the Northwest. The article is illustrated by five engravings from reports of the Bureau of Ethnology. "The Discovery of New Chemical Elements," by Clemens Winkler, is a most interesting and important chemical study, especially when taken in connection with another article which is published in this issue—C. F. Brush's "A New Gas." This is a full paper, which Mr. Brush presented at the American Association for the Advancement of Scince, on "Etherion." "Excavations at Corinth" is an interesting paper by Prof. Rufus B. Richardson, director of the American School at Athens. "Electroplating on Wood" is an article giving full formulas. "The Inaugural Address" of Sir William Crookes before the British Association is concluded in this number.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Bicycle Appliances.

BICYCLE-HOLDER.—DAVID A. BROWN, Woodbridge, N. J., and FRANK M. WILLIAMS, Belleville, N. Y. By providing a bicycle-support comprising a loop forwardly curved at its upper portion and mounted to swing on a vertical wall, an arm extended from the lower end of the loop, and a frame-engaging plate on the arm, these inventors are enabled to hold a bicycle securely against the wall of a building, baggage-car, or the like. When placed in the holder, the front wheel of the bicycle rests upon the loop, the frame-engaging plate supporting the bicycle free from the floor.

BICYCLE.—PHILIP J. PARKER, New York city. This bicycle belongs to the chainless type and is so constructed that the driving power is directed from the center of the pedal-shaft and not from the side. By this means the inventor claims that the strains on the two sides of a bicycle frame are equalized and that a much larger driving-gear can be used than has hitherto been possible. By having the rear wheel at one side of a line drawn from the front wheel, three gear-wheels may be used, the least number that can be employed, thereby reducing the friction.

Engineering Improvements.

ROTARY ENGINE.—JAMES C. WALKER, Waco, Tex. This invention embodies an improvement whereby the abutment-slides and inlet-valve devices forming part of an engine patented by the same inventor may be more efficiently operated. The engine comprises a nest of cylinders. On the drive-shaft the disks which carry the cam-devices for operating the abutment-slide valves are fixedly mounted. For the cylinders a cut-off valve mechanism is provided. Lever devices are employed to produce a reciprocating action of these valve-mechanisms. On a drive-shaft geared with the main drive-shaft, centrifugally-operated cut-off devices are mounted and held to engage and impart a reciprocating action to the valve-shifting-lever devices.

Mechanical Devices.

DRILLING-TOOL.—WILLIAM H. SKINNER, Darlington, La. Within the casing of this tool a bit-stock is mounted to rotate and is provided with a socket-end. In the end of the bit opposite the socket-end, a feed-screw is fitted and provided with a centering point and two grooves below the point. Over the end of the feed-screw a cap is fitted in which a set-screw is located and adapted to enter either of the grooves to cover or expose the centering point.

GIRDER-RAIL GROOVE-CLEANER.—LOUIS F. MEYER, Richmond, Va. This device comprises a laterally-movable plow and a brush located in the rear thereof and held from lateral movement, the brush being arranged to run directly behind the plow when the latter is in normal position, as when cleaning a straight rail. This invention, it is claimed, will dispense with the services of a force of rail-cleaners and perform the work more thoroughly than is ordinarily accomplished by hand.

GRINDING AND PULVERIZING MACHINE.—JOHANN POETTGENS, Berlin, Germany. One of the distinguishing features of this machine is the novel shape of the inner wall of the stationary "drum" or chamber inclosing the grinding or pulverizing mechanism. The arrangement of a series of grinders or beaters, whereby these are adapted to act by centrifugal force upon or in conjunction with the non-circular inner surface of the drum in such a manner that the substance is disintegrated alternately by attrition and pounding, is also noteworthy. In addition to this, the beaters may operate under the action and control of springs designated to fulfil the double object of increasing the effect of the beaters and as far as possible preventing their recoil.

EXCAVATOR.—NEWSOME C. WRIGHT, Nashville, Tenn. This apparatus is especially adapted for use in excavating foundations, sewers, ditches, and the like, and consists of a bed-frame or platform on which power-hoisting mechanism is mounted and a longitudinally-extending guideway, along which a block-frame is movable. A hoisting-line, a backing line, and a line for operating the block-frame are provided and connected with their respective drums on the hoisting-mechanism. The inventor has also provided means by which the scraper may be filled and dragged to the hoisting devices. After having been filled the scraper will be elevated and swung to any point, unloaded, and returned to the excavation by the backing line.

TIRE-SETTING MACHINE.—CHRISTIAN MATHISEN, Fredericksburg, Tex. The purpose of this invention is to provide a machine whereby a tire can be quickly set cold upon a rim. The machine has a lever adapted to be temporarily fulcrumed at the hub of a wheel. On the lever a roller is journaled and adapted to engage the inside of the tire. A bearer is also journaled on the lever and adapted to engage the edge of the tire. On a slide, adjustably held on the lever, a second roller is journaled and adapted to engage the peripheral surface of the wheel rim. Means are provided for moving the slide on the lever.

KNITTING-MACHINE.—ISAAC W. LAMB, Perry, Mich. The machine devised by this inventor is especially designed to knit fabrics composed of two ribbed fabrics, the selvage yarn of one fabric being extended between the front and back loops of the selvage of the other fabric to form the two in one piece. The machine is provided with needle-plates on which sets of needles are located. Yarn-carriers carry the yarn to the corresponding sets of needles. A sewing-needle is mounted between the two sets of needles on one of the needle-plates to join the fabrics formed by the sets of needles. Means are provided for imparting movement to the sets of needles and to the sewing-needle. Mechanism is also provided for shifting the sewing-needle into a preliminary position to receive the second yarn from one of the carriers, without causing the sewing-needle to cast its old loop.

MACHINE FOR SORTING FRUIT OR VEGETABLES.—A. O. DILLMAN, South Haven, Mich. This fruit-assorter has an assorting roll provided with a gravity blade having movement to and from the periphery of the roll. An assorting table having a hinged section is arranged for contact with the blade when the blade extends beyond the periphery of the roll. The fruit is fed from a delivery-trough. As the rolls revolve, the spaces therein assume a vertical position. The mouths of the spaces being uppermost, the fans or blades will drop down into the spaces; but when the mouth portion of the spaces on the assorting rolls faces downwardly the blades drop out. As the rolls continue to revolve, the fruit that has been unable to pass between the rolls will be taken and carried to the next roll between which the space is wider.

CLOTH-CUTTING MACHINE.—NICOLAS KONOW, New York city. In this cloth-cutting machine an electric motor is used to impart rotary motion to a revoluble cutter journaled in a hollow standard. The drive-shaft extends down into the hollow standard and is provided with a beveled pinion on its end. A beveled gear is mounted in the hollow standard and engages the beveled pinion of the motor shaft. The cutter is secured to and revolves with the gear-wheel. When using this machine the operator has a clear view of the cloth ahead, thus enabling him to cut accurately along the desired line.

GEAR-CUTTING MACHINE.—NELSON A. WHEELER, Stockton, Cal. With this machine a great variety of adjustments can be made, so that gear-teeth of various types can be cut therewith. With the work-holder a cutter-guide is connected, the axis of which is arranged at an angle to that of the work-holder. The cutter is mounted to reciprocate on the guide. The guide is adjustable on a bracket transversely of the direction in which the cutter reciprocates, the bracket being pivotally mounted to permit its angle to be changed relatively to the work-holder.

COIN-COUNTER.—CHARLES J. WOLF, Memphis, Tenn. This invention is an apparatus for receiving money and for making change automatically, both operations being effected upon striking a key denoting the amount of the purchase. On the base of the machine is situated a casing which is flanked on each side by two small drums. The casing contains devices for receiving the coins and expelling the change thereof. The drums are constructed to receive the paper notes, and upon the action of certain elements, to permit the extraction of the requisite change in paper money. The coin devices comprise a coin-stack for each denomination, each stack having keys and ejectors to control and push out the several coins. The arrangement is such that, upon inserting the money tendered in payment for goods received into the machine, and upon striking a key denoting the amount of the bill or purchase, the amount of money representing the change will be ejected from the money receptacles of the apparatus.

Miscellaneous Inventions.

HOLDER FOR NURSING-BOTTLES.—ALEXANDER C. BUCK, Jamesburg, N. J. This holder has a base provided with a contracted front portion extended upwardly to form a standard. A spring-lug is located at each side of the base. Another spring-lug is located at the rear portion of the base. These lugs support the bottle in connection with an orifice through which the neck of the bottle extends.

HEN'S NEST.—MILO S. BARNES, Garner, Iowa. The hen's nest provided by this inventor is so arranged that when a hen steps upon the nest-box, a bar rotates and fingers close up behind her, thus preventing the entrance of a second hen. When the hen desires to leave the nest, she steps upon a platform, which action causes the fingers to fall and raises the box ready for action a second time.

SAFETY ATTACHMENT FOR FIREARM-LOCKS.—ORLANDO ROSE, Crown Point, Ind. The purpose of this invention is to provide an attachment for guns or revolvers that will prevent the hammer from being moved to explode the cartridge before it is fully cocked. The movement of the hammer to a full cock brings a trip-lever under the locking or safety-lever to hold it out of the path of the hammer, the hammer operating the trip-lever to free the safety-lever.

RACE-TRACK FOR DOGS.—MICHAEL WALSH, New York city. With this improved track the speed of dogs may be tested in such a manner that the animals are completely unencumbered by harness or the like. Movable in the track is a support adapted to carry a dummy hare or other object in view of the pursuing dogs. The support is moved forward in front of the dogs by means of a motor.

FUR-TRIMMING FOR LADIES' HATS.—JOHN F. VORCK, New York city. The fur feathers comprising this hat-trimming consist of fur quills and a core therefor, and a base to which the inner ends of the feathers are secured.

GAME-APPARATUS.—HENRY T. PYCROFT, Parnell, Auckland, New Zealand. In this apparatus, two boards are mounted on a base and adapted to be inclined oppositely. A cage is mounted at the upper end of each board. In using the apparatus, balls are first placed in the cages. At a signal, the players, two in number, simultaneously release the balls. Then with an arresting instrument the players each endeavor to stop the balls. When a ball is arrested, the player scores as many points as there are units marked in the place where the ball has been stopped. Should the ball, however, be not arrested, it rolls into one of several compartments. The number of units marked in the compartment in which the ball has come to rest denote the number of points scored by the opponent of the player who has been unsuccessful in arresting the ball.

ATTACHMENT FOR SHOES.—ROBERT M. HAYWARD, New York city. The inventor of this attachment arranges a strip of yielding material within the shoe or boot at the side occupied by the big toe. The strip is designed to keep the toe in its proper position to prevent the formation of "bunions."

BROILING AND TOASTING DEVICE.—ELLA M. ALDERSON, Asbury, W. Va. This broiler and toaster comprises a body having a top wall and two end walls, a carrier-rod passing through the end walls and having handles on the ends which frictionally engage these walls to prevent accidental rotation, and a series of spaced hanger-fingers on the hanger-rod, adapted to receive and hold material to be broiled or toasted, by hanging the material on the pointed ends of the fingers.

BARREL.—MERRILL H. TILGHAM, Norfolk, Va. The head of this barrel is composed of a number of sections overlapped at their ends, curved at their outer sides to fit the barrel and provided with an open space between their inner edges adapted to permit the insertion of truck and to be closed by a cross-slat.

Designs.

MATCH-BOX.—JAMES J. B. MCELRATH, Centre, Ala. The match-box forming the subject of this design has a shield-like body, surmounted by a compass, the lower ends of the legs merging into the shield. A square crosses the compass and connects with the central upper portion of the shield. Between the square and the compass the letter "G" is mounted.

FABRIC.—WILLIAM KEIL, New York city. The leading feature of this design consists in a striped body and panels into which the stripes merge, and in floral decorations for the border thereof.

FABRIC.—WILLIAM KEIL, New York city. This design provides a fabric having a body and a border. The body has alternate checkered and foliated stripes. The border is separated from the body by an ornamental bar and is decorated with foliate cruciform figures, alternating with spire foliate figures. The border is further decorated with a skirting, having festoon-connected foliate pieces.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7510) C. J. T. asks if two one-candle power electric lamps, each of 3½ volts 0·50 amperes, could be lit in series on a 3½ volt circuit. A. No. If one lamp takes one-half ampere at 3½ volts to light it, two in series will take one-half ampere at 7 volts to light them; but in parallel, the two will take one ampere at 3½ volts to light them. If a lamp requires the entire voltage to force current through it, you cannot put another lamp on the end of it and have the same current flow through both. To find the number of lamps in a series, divide the voltage of the circuit by the voltage one lamp. When the lamps are in parallel, the same voltage serves for all; but each lamp takes from the circuit the amount of current it requires. See Electrical Incandescent Lighting, Houston & Kennelly. Price $1, by mail.

(7511) A. A. R asks for the formula for making the gum in use on postage stamps, and oblige. A. For postage stamp mucilage, try the following: Gum dextrine, 2 parts; water, 5 parts; acetic acid, 1 part. Dissolve by the aid of heat and add 1 part of 90 per cent alcohol.

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UP-TO-DATE AIR-BRAKE CATECHISM. Containing nearly one thousand questions, with their answers, intended as examination questions, for engineers and firemen, as well as all other practical railroad men. By Robert H. Blackall. Fully illustrated. New York: Norman W. Henley & Company. 1898. Pp. 224. 12mo. Price $1.50.

There is a law compelling companies to have a sufficient number of cars equipped with air brakes, by January 1, 1900, to control the trains. In view of this fact, there is a vast army of railroad employes, specially engineers and train crews and air brake machinists, who must acquire information on the subject. There is no question that a complicated mechanism like the air brake demands a practical and thorough understanding of the subject by all who are concerned in any way with its operation, maintenance, or repair. There is no book published which gives a complete study of the air brake equipment, including the latest devices and inventions used. It is to meet the demand for such a book that the present work is designed. The popular question and answer form is used, and all things considered, this is the best system, as the information must necessarily be supplied in concrete form. The illustrations are numerous and are very clear and well executed. At a time when railways require special instruction cars and instructors and inspectors, a book of this kind cannot fail to have a great success. It is a work we can confidently recommend.

ZEITUNGS-KATALOG UND INSERTIONS KALENDER. Hamburg: Rudolf Mosse. 1898. Pp. 362, quarto.

The present work is a list of various papers published in Germany and other countries. It appears to be very full and complete, specially the classified list of scientific and trade publications. The book is accompanied by a handsome calendar which is bound in, and the whole is neatly bound in leatherette.

ELECTRICITY IN THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE NOSE, THROAT, AND EAR. By W. Sheppegrell, A.M., M.D. New York: G. P. Putnam's Sons. 1898. 8vo. Pp. 403. 155 illustrations. Price $4.50.

The author has been an officer in many medical societies devoted to the study of the nose, throat, and ear, and is also a practicing specialist; which all fits him for writing the present work, which is a complete treatise on the use of electricity in the diagnosis and treatment of diseases of the nose, throat, and ear. It is filled with illustrations describing the very latest apparatus and methods of operation. It is a book which will be hailed with delight by all specialists. Some idea of the mine of material which the author has explored will be obtained when it is stated that there are no less than 565 bibliographical references.

COMMERCIAL ORGANIC ANALYSIS. By Alfred H. Allen, F.I.C., F.C.S. Vol I. Introduction: alcohols, neutral alcohol, derivatives, sugars, starch and its isomers, vegetable acids, etc. Philadelphia: P. Blakiston, Son & Company. 1898. Pp. 557. 8vo. Price $4.50.

The properties, proximate analytical examination, and modes of assaying the various organic chemicals and products employed in the arts, manufactures, and medicine, with concise methods for the detection and determination of their impurities and products of decomposition, are treated in the present edition, which is the third. It has been revised by the author and matter has been added by him. Dr. Henry Leffmann has also assisted, revising and adding matter. The last edition of this volume was issued in 1885, and has been out of print for several years, though the demand for it has been considerable. It was recently reprinted without permission of the author and without revision, and, as this reprint necessarily misrepresented Mr. Allen's present views on many subjects, he determined to issue a revised edition immediately, and the result is the edition before us. The work, by its scope, thoroughness and accuracy, has been well received by chemists and has been for a long time regarded as one of the most important volumes which chemists can have in their libraries. The present book contains the very latest researches, and we have no hesitation in recommending it to all who are in need of a work on the commercial side of organic analysis.

A PRACTICAL TREATISE ON MODERN GAS AND OIL ENGINES. By Frederick Grover. Manchester, England: The Technical Publishing Company, Limited. New York: D. Van Nostrand & Company. Pp. 256. 12mo. 123 illustrations. Price $2.

In writing these pages the author has endeavored to supply to the average mechanical draughtsman the information necessary to enable him to apply his art to the design of gas engines. From this it will be seen that the work before us is designed on rather different lines than other works on gas engines. Such subjects as physical properties of oils, oil engines, vaporizers, and a few special points in connection with oil engine testing, are also considered. The book is well illustrated by clear diagrams and engravings.

INDICATOR DIAGRAMS AND ENGINE AND BOILER TESTING. By Charles Day, Manchester, England: Technical Publishing Company, Limited. New York: D. Van Nostrand Company. 1897. Pp. 212. 12mo. Illustrated. Price $2.

The purpose of the first portion of this book is to explain the construction of the different kinds of indicators used and show their advantages and disadvantages, and also to explain clearly the general principles on which the interpretation of the indicated diagrams is based. A large number of descriptive diagrams are illustrated and described. In the second part of the book the testing of engines and boilers is considered. This will supply a want on the part of those who have not already had experience in such work. The illustrations number 126 and fully elucidate the text.

JOURNAL AND PROCEEDINGS OF THE ROYAL SOCIETY OF NEW SOUTH WALES FOR 1897. Vol. XXXI. Edited by the Honorary Secretaries and published by the Society at Sydney, New South Wales. Pp. 554. 8vo. 20 plates.

The Royal Society, New South Wales, originated in 1821. The Philosophical Society of Australasia and the present society were incorporated in 1881. The volume before us, in addition to addresses and proceedings, contains a number of important papers, notably that of Professor Liversidge on the "Crystalline Structure of Gold and Platinum Nuggets and Gold Ingots," illustrated with a number of photographs and plates. So far as we know, this is an entirely unique paper and possesses great value. There are a large number of other papers on astronomical, physical, archæological, ethnological, mineralogical, meteorological, and technical subjects. The book is fully illustrated and it is interesting to see what is being done for science in this far-away part of the world.

THE DISCHARGE OF ELECTRICITY THROUGH GASES. By J. J. Thomson. New York: Charles Scribner's Sons. 1898. Pp. 203. 12mo. Illustrated. Price $1 net.

The present work consists of lectures delivered on the occasion of the sesqui-centennial celebration of Princeton University, by Prof. J. J. Thomson, of the University of Cambridge. With the hope of making the work more useful, the author has added some results which have been published between the delivery and the printing of the lectures. The celebration at Princeton in 1896 was one of the most memorable occasions in the university life of America, and the publishers are to be congratulated in putting in permanent form the lectures delivered by the guests of the University.

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